PUBLIC WORKS

Founded in 1896

Devoted to the interests of the engineers and technical officials of cities, counties and states

Vol. 75 No. 9

A. PRESCOTT FOLWELL, Editor

SEPTEMBER CONTENTS

Published monthly by PUBLIC WORKS JOURNAL CORPORATION
Editorial and advertising offices: 310 East 45th St., New York 17, N. Y.

J. T. MORRIS, *President*; CROXTON MORRIS, *Treasurer*; A. PRESCOTT FOLWELL, *Secretary*. *Advertising representatives:* New York: ARTHUR K. AKERS, *Advertising Manager*; LEWIS C. MORRIS; Cleveland: ALONZO HAWLEY, 326 Bulkley Building, Cleveland 15, Ohio. SUBSCRIPTION RATES: U.S.A. and Possessions, Mexico and Cuba, $3.00; Canada, $3.50. All other countries, $4.00. Single Copies, 35 cents each except issues containing book-length texts, which are $1.00 apiece.

THE WAR EMERGENCY

The Federal Road Construction Program

The Federal-aid postwar highway bills have not yet passed Congress, but as we go to press it seems practically certain that both houses will pass one within the next few weeks. Senator Barkley, majority leader, is reported to have said that he expected the Senate to pass the Hayden bill before the end of September. The Senate bill, S2105, differs from the House bill, H.R. 4915, in several particulars. S2105 raises the 3-year appropriation from the 1.5 billion dollars of the House bill to $1.95, of which 750 million is for Federal-aid highways, 600 million for farm-to-market roads, and 600 million for urban highways.

By the House bill the funds would be apportioned among the states on the basis of ½ population, ¼ area and ¼ postwar mileage. By the Senate bill the appropriation for rural roads would be based 1/3 on population, 1/3 on area and 1/3 postwar road mileage; for urban highways on the ratio which the population of municipalities of 5,000 (10,000 in House bill) or more in any State bears to the total urban population of the nation.

In the House bill the States must supply 40% of the cost of the first year's construction and 50% of that during the two following years. In the Senate bill the State appropriation would be 40% for the entire three years.

Both bills provide funds for projects on the Federal-aid highway system in urban areas; also 25 million for forest highways, 12.5 million for forest development roads, 4.25 million for parks and monuments and 5 million for parkways.

The Senate bill would make 100 million available immediately for making surveys and plans, the acquisition of rights-of-way, and construction.

Of the $60,000,000 Federal funds made available to state highway departments for postwar planning, two-thirds was unclaimed at the latest report; apparently many states prefer to handle planning with their own funds, saving the Federal funds for construction, $50,000,000 of the fund being available for either purpose for a year after the emergency; only $10,000,000 being confined to planning only, and about two-thirds of this had been allotted by June 3th.

Ceiling Prices on Construction Work

Under an OPA regulation effective August 26th, all building and construction contracting, including water-well drilling, is subject to price regulation. The ceiling price is the highest unit rate charged a purchaser of the same class for the same kind of job during March 1942, plus the additional cost for materials (up to their ceiling prices) and increases in labor costs, including increases in Federal old age benefits, unemployment compensation taxes, workmen's compensation and public liability insurance. If you did not do the same kind of work in March 1942, you must obtain approval of a ceiling price from the OPA District Office.

Plenty of Snow Plows Available

WPB has stated that sufficient snow plows will be available to meet 1944-45 essential civilian requirements. Civilian needs could not be met in the 1942-43 and 1943-44 seasons, because of the military demand, WPB officials pointed out. The Army has now cut back nearly all of its 1943-44 contracts, however, and it appears that both Army and Navy requirements for 1944-45 will be light. As of June 30, 1944, less than 100 units were unshipped on military orders.

Demand for snow plows from civilian Governmental bodies for 1944-45 is not as high as had been anticipated, and there appears to be adequate production capacity to meet all essential civilian needs for the coming winter. The supply of cutting edges for snow plows is also adequate.

Keep Garbage Covered

Garbage, whether in householders' cans or public dumps, should be kept covered to prevent fly and insect breeding. Linking the spread of infantile paralysis to flies and other insects, public health authorities are asking citizens throughout the nation to wrap their garbage and keep their garbage cans covered, and urging more frequent collection of garbage.

Shortage of man power has led many cities to make collection of refuse less frequently than formerly. Is this one cause of the increase in infantile paralysis in many parts of the country?

Sanitary Engineers and Hunting Seasons

The South Dakota Water and Sewage Works Conference set September 19 and 20 as the date for their annual meeting at Watertown. But it was learned last month that the pheasant hunting season will begin at that date—earlier than ever before—and all hotels in that and neighboring cities have standing reservations for all their rooms for the opening of the hunting season, so there would be no accommodations for the water and sewage works men, and the meeting has been postponed to November 14 and 15. This goes for the North Dakota League of Municipalities also.

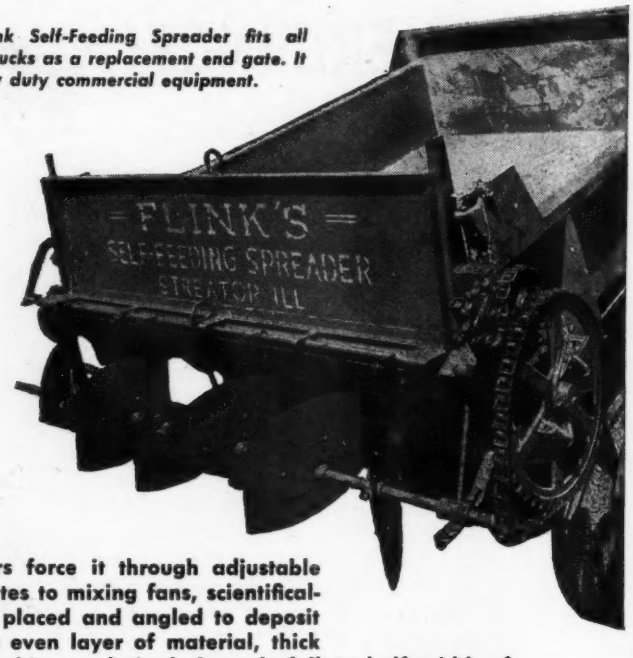
Other societies have cancelled their meetings because of the Nazi hunting season, these including the New York, North Carolina and Western Pennsylvania Sections of the American Water Works Association, and the League of Municipalities and Sewage Works Association of North Carolina.

Postwar Plans in California

On August 17th the State Finance Director of California informed the municipalities of that state that they may begin filing applications for their shares of the $10,000,000 appropriated in June by the State legislature, to be allocated on a matching basis, for aid in preparing plans and purchasing sites for postwar projects.

for ICE CONTROL...

HOW 1 FLINK DOES WORK OF 3 TRUCKS IN ICE CONTROL



The Flink Self-Feeding Spreader fits all dump trucks as a replacement end gate. It is heavy duty commercial equipment.

In a large midwestern city (names of officials on request), 5 men driving Flink equipped trucks replaced 15 trucks and 30 men, controlling as many miles of streets in less time. The answer was the speed and self-feeding ability of Flink spreaders. See below.

Faster. **Icy streets and dangerous intersections are brought under control many valuable minutes *faster with fewer men,* because Flink WD3 spreaders, equipped with the Flink clutch control can be operated at 12 to 20 miles per hour without stopping truck. Driver speeds rapidly towards danger area, throws spreader into action as he reaches it, and out of action as he finishes treating the icy spot . . . then proceeds at higher speed to next spreading area. Entire operation controlled from cab.**

Self-feeding. **Raising the dump truck causes material to fall against the spreader. Positive agitators force it through adjustable gates to mixing fans, scientifically placed and angled to deposit an even layer of material, thick or thin, as desired. Spreads full or half width of street. Throws material down low, not on passing or parked cars.**

Spreads all granular materials, **wet or dry, up to 1", forward or backward. No clogging or bridging. Let us send you more complete information on the use of Flink Self-feeding material spreaders for highway and street ice control.**

for SEAL COATING...

HOW FLINK *Self-Feeding* SPREADER DOES SEAL COATING BETTER

Spreads an even layer of material, thick or thin—as desired, as the truck is backed up . . . thus avoiding damage to tires or leaving tracks of oil. Spreads full width of street. Does it faster, smoother with less help.

Flink self-feeding **material spreaders save time, materials and reduce accidents. They have been proved in tough road construction and maintenance jobs all over the country.**

Faster. **Operated by driver from cab who can throw spreader in and out of action as he approaches or leaves area to be spread.**

No helper. **Raising the dump truck causes load to fall towards spreader. This plus positive agitation, eliminates man on back.**

Fits all dump trucks. **The Flink spreader is a replacement end gate, it is not a body, a trailer or a "gadget."**

Does not limit use of truck. **Dumps same as with regular end gate, or replace original end gate in 5 minutes. Continue to use truck for all other purposes.**

Efficient use of materials. **Spreads thick or thin, evenly . . . without bare spots as with hand or revolving disk methods. Spreads all materials up to 1". Write for complete information.**

Flink Spreaders **are ideal for all types of road and street spreading, for ice and dust control, for spreading agricultural limestone. Write for literature. State your spreading problem.**

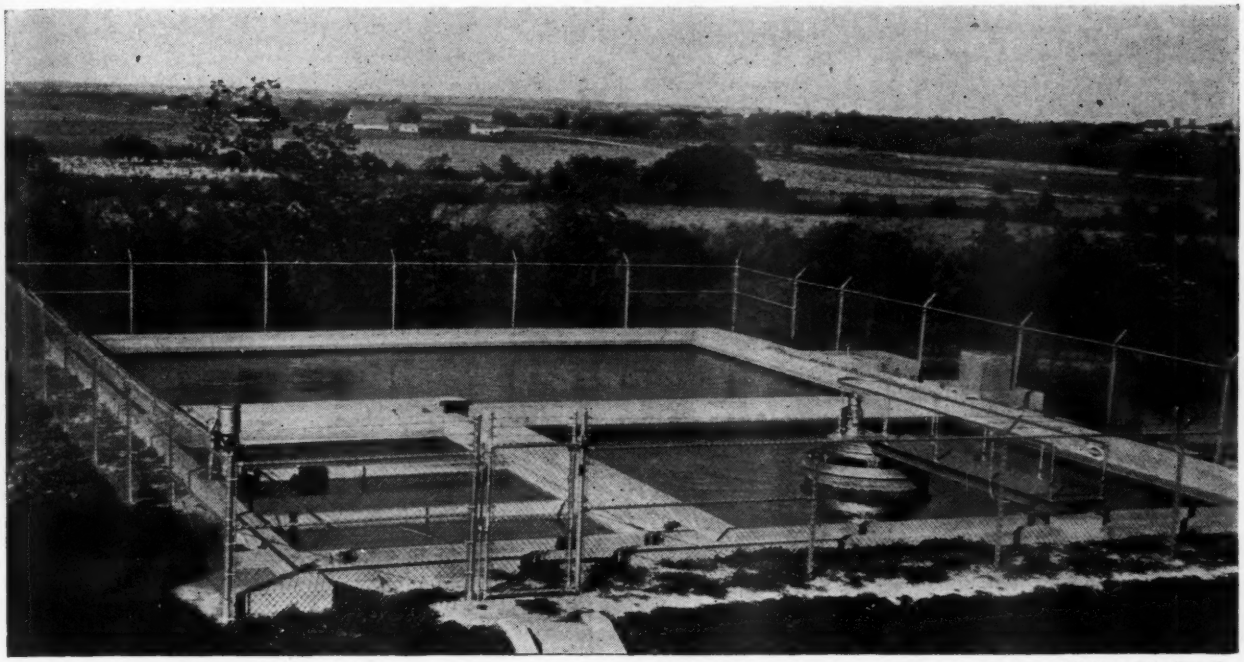
the Flink *Self-Feeding* Spreader

For Complete Information Write **THE FLINK CO., 506 Vermilion St., Streator, Ill.**

When writing, we will appreciate your mentioning **PUBLIC WORKS**

PUBLIC WORKS Magazine . . . September, 1944

Vol. 75. No. 9



Courtesy of the Dorr Co.

Plant for a town of about 5,000 population—Osawatomie, Kansas—using alum and lime, rapid and slow mechanical mix, liquid chlorine, mechanical sludge removal, ammoniation and rapid sand filters.

A Study of Recent Water Treatment Plants

Methods and devices used in 474 plants constructed since 1940 by communities of all sizes, grouped by sizes and by geographical districts.

IN OUR July issue under the head "Present Trends in Water Treatment" we tabulated data collected by the U. S. Public Health Service's Water and Sanitation Investigations Station, S. R. Weibel, Public Health Engineer, giving information concerning water purification plants constructed during the years 1941-42, and discussed those relative to sources of supply and, briefly, the methods of treatment employed.

The reliability and completeness of the data available seemed to make it worthwhile to study them more thoroughly, and the following is the result of such study. It includes data from 474 communities, relative to plants constructed by them in 1941 and 1942 (a few completed in 1943), and is believed to include all (except perhaps a very few) that were constructed during those years, except those at Federal camps and other military installations, none of which were included.

The data have all been totaled by states, and the state totals are shown in the accompanying tables.

In the first six tables, one for each population group, the states are arranged by geographical districts. The figures indicate the number of communities in that state using the treatments or devices indicated by the letter at the top of the column. For example: Table 1 shows that in New Hampshire, plants were installed by 2 communities of 100 to 1,000 population, both however including nothing but disinfection. (Tables 1 and 2 are on page 12; the others are on pages 36 and 38.)

In studying these figures we grouped the 474 communities in two ways—by population and by geo-

The symbols used by the U.S.P.H.S. in their tabulation, and by us in our tables, and the treatments or devices they indicate are as follows:

A — Aeration
C — Chemical dosage for coagulation or softening
D — Disinfection
F — Filters
H — Softening
I — Iron or manganese removal
K — Chemical dosage for corrosion correction or water stabilization
M — Mixing device or tank
N — Ammoniation
R — Recarbonation
S — Sedimentation
T — Activated carbon

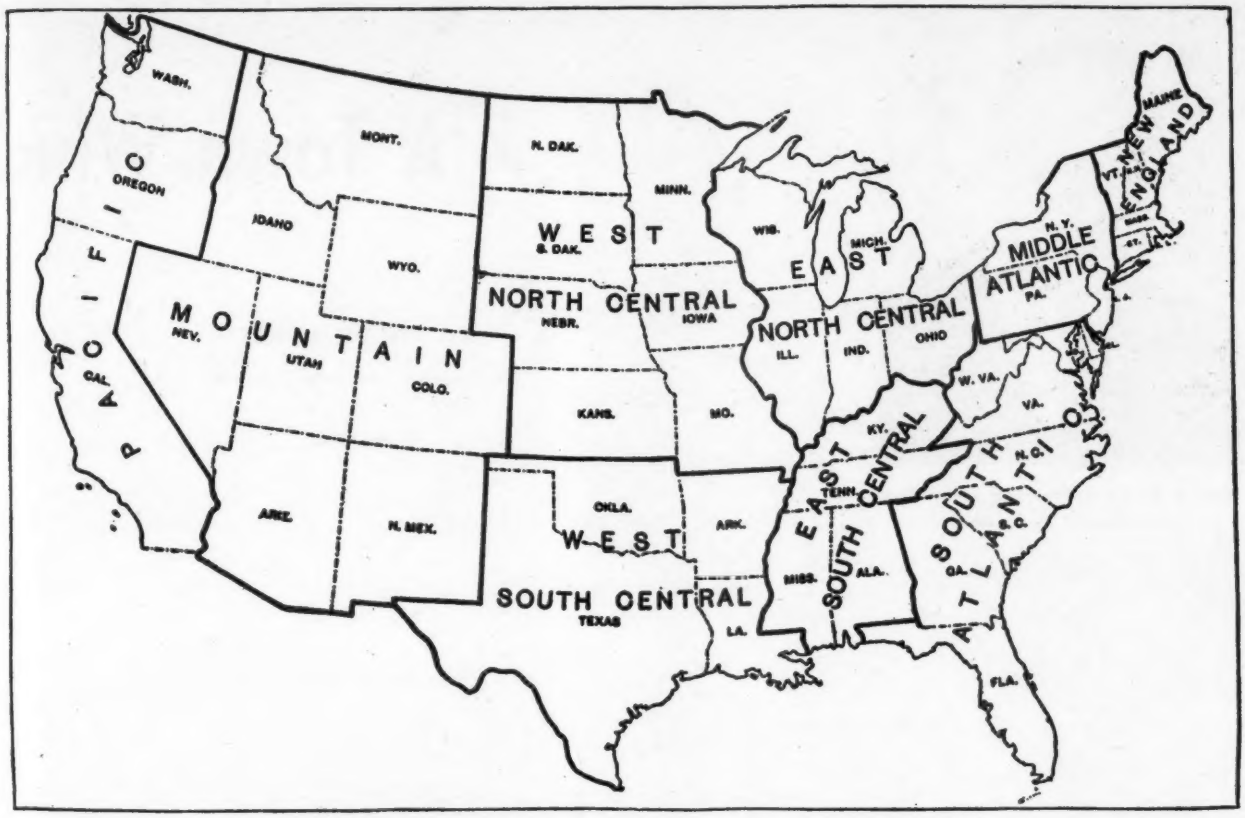
The order in which these appear in the tables is approximately that in which they are used in the plant, the first two—I and H—indicating the type of plant.

Table 1.—Class A Communities, With Populations of 100 to 1,000

State	No. of Places	I	H	A	C	T	S	M	F	D	N	K	R
New England													
New Hampshire	2									2			
Massachusetts	1								1	1			
Middle Atlantic													
Pennsylvania	20									20			
South Atlantic													
Maryland	2			2					2	2		2	
W. Virginia	3	2	1	2	3		3	1	3	3			
N. Carolina	3			1						3		1	
Georgia	4				1		1	1	1	3		2	
Florida	4				3		3		3	4			
East North Central													
Wisconsin	2	1	1	1			1		1	1		1	
Ohio	27	13	16	16	16		18	15	22	8			15
Indiana	12	1		1	1		1		1	12			
Illinois	17	13	6	12	1		12	1	14	6		7	
East South Central													
Kentucky	11		2	1	7		7	4	9	10		1	
Alabama	5	2	1	3	2		2	1	3	5		2	
Mississippi	1									1			
West North Central													
S. Dakota	3	1		1	1		1	1	2	2			
Minnesota	13	1		6	1				6	2		5	
Iowa	26	14	14	15					22	21		15	
Nebraska	3	2	1	3			1		2				
Missouri	2	1	1	2	1		2	1	2	2		1	
West South Central													
Louisiana	2		1		1		1	1	2	1			
Texas	3	1		1	1			1	2	2			
Mountain													
Colorado	5								1	4			
Pacific													
Washington	2									2			
Totals	173	52	44	67	39	—	53	27	99	117	—	37	15

Table 2—Class B Communities, With Populations of 1,000 to 5,000

State	No. of Places	I	H	A	C	T	S	M	F	D	N	K	R
New England													
Maine	2				2		2	2	2	2			
Vermont	1									1			
Massachusetts	5		1						1	4	1	1	
Connecticut	3									3			
Middle Atlantic													
New York	2		1	1					2	1		1	
Pennsylvania	13		2	3	9	1	8	9	8	13		1	
South Atlantic													
Maryland	2	1	1		1		1	1	2	2			
Virginia	1				1		1	1	1	1			
W. Virginia	1		1		1					1			
N. Carolina	3				3		3	3	3	3	3	2	
S. Carolina	3				3	2	3	3	3	3		3	
Georgia	9				7	2	9	6	8	9	2	5	
Florida	4			3	1		1		1	2		1	
East North Central													
Wisconsin	5	4	2	4	1		1		4	4		2	
Michigan	4	4	1	4					4			2	
Ohio	6	1	1	2	1		1	1	2	6			1
Indiana	8	1	2	1	2		1	2	3	8		1	
Illinois	9	1	3	1	3	2	3	4	4	8		2	
East South Central													
Kentucky	5		2	1	5	1	5	4	4	5		1	
Tennessee	5		2	3	4		4	4	4	5	1	3	
Alabama	5				4		4	4	4	5		1	
Mississippi	2									2			
West North Central													
N. Dakota	2		2		2		2	2	2	2			
S. Dakota	2									2			
Minnesota	24	3	6	10	7	4	8	4	11	10	6	20	5
Iowa	8	4	2	4					5	4		2	
Nebraska	5	2		4			2		5				
Kansas	2									1		1	
Missouri	2		1		1		1	1	2	2			
West South Central													
Arkansas	4	1		3	3		3	2	3	4			
Louisiana	6									6	1	1	
Texas	9		2	4	4	1	3	4	3	9	1		
Mountain													
Colorado	5								2	5			
Utah	1				1			1	1	1			
Arizona	3			3	3		3		1	1			
Totals	171	22	32	51	69	13	69	58	95	135	15	50	6

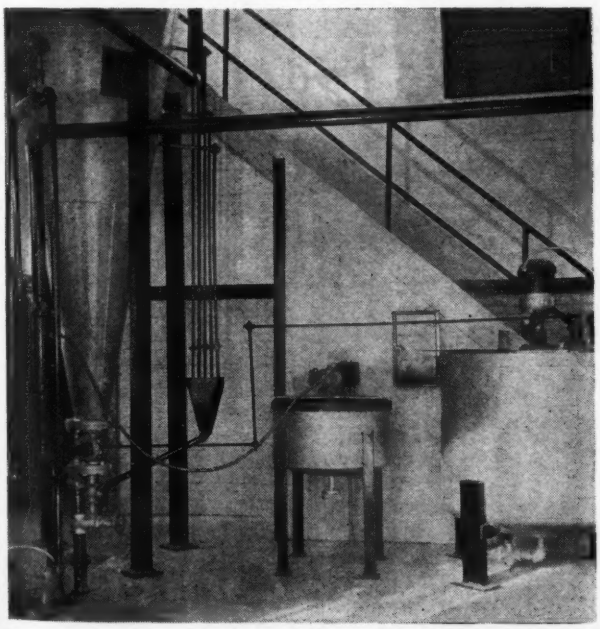


Map of the United States, showing states in each geographical district.

graphical districts. The population groups are as follows:

A — 100-1,000
B — 1,000-5,000
C — 5,000-10,000
D — 10,000-25,000
E — 25,000-50,000
F — More than 50,000.

The geographical districts are those employed by the Federal government (see map): New England, Middle Atlantic, South Atlantic, East North Central, East South Central, West North Central, West South Central, Mountain, and Pacific.



Courtesy Permutit Co.
Spiractor and electro-chemical feed in village of about 1,000 population.

In table seven the data for the entire country are grouped by populations and also by geographical districts, and the figures given are the percentages of the communities in each group that adopted each of the treatments or devices. For example, of the 173 communities in Group A, 30.1% employed iron or manganese removal, 25.4% employed softening procedure, 38.7% aeration, 22.5% chemicals for coagulation or softening, etc. Of the 474 communities that introduced treatment in 1941-42, 79.1% employed disinfection, 55.9% filtration, 40.2% sedimentation, etc.

Examination of these tables shows the order of popularity (not strictly the correct term but used for convenience) of the several treatments by groups. For example, disinfection (D) is seen to be the most commonly used treatment in every population group, and also in every geographical group except one—the West North Central, where filtration leads. To make the picture clearer, Table 8 has been prepared showing the order of popularity of each type of treatment by each population group and by each geographical group.

Examination of the population group table shows that disinfection leads for all sizes of communities, followed by filtration for all groups except D and F. Recarbonation is the least used process in 2 of the 6 groups, these, Groups A and F, using it in 15 out of 173 plants and 2 out of 22 respectively. None of the smallest plants uses ammoniation and none of the largest uses iron or manganese removal.

To a certain extent the Group A plants are in a class by themselves; the other groups agree fairly closely in their practice. The order of popularity of processes in plants of 100 to 1,000 population is: disinfection; filtration; aeration; sedimentation; iron removal; softening; chemical coagulation; corrosion correction; mix-

(Continued on page 38)

Angus E. Slee, Past President Rocky Mountain Sewage Works Ass'n.

A Town Which Re

By ANGUS E. SLEE

City Engineer, Longmont, Colorado

"A TOWN or a county which comes up with a postwar job already laid out is going to be tough to regiment, and it could conceivably contribute something vital to national understanding of a task which we can't afford to muff." — *From an editorial by Frederic Nelson in the Saturday Evening Post for August 5, 1944.*

Although these lines were published more than a year after the City of Longmont inaugurated its postwar planning of public works, they embody the principal ideas behind the program. Guiding and motivating forces behind the program have been the Committee on Water and Sewage Works Development, the Veterans of Foreign Wars, and the Committee for Economic Development of the U. S. Chamber of Commerce. These and other organizations have sowed their seed; it is my purpose to report on the condition of the crop at Longmont, Colorado (1940 population, 7406).

One of the first questions considered was how much money would be available for replacements and new construction. The city's income is derived from the net profit of the electric and water departments, the 5-mill-city tax (lowest in Colorado) and miscellaneous city collections. From this total, appropriations are made each year to finance the normal operation of the city government, including police and fire protection, street maintenance, library, park and contingent funds. A ten-year history of the income and appropriations was compiled; this showed an annual average excess of income over appropriations of $54,841.83. In past years, these funds have purchased an adequate water supply for the city, constructed a 2,922 kw Diesel plant, a 5 mgd rapid sand filtration plant, a 1.25 mgd sewage treatment plant, a $72,000 storm sewer system, paved 95% of the city streets, and established a park and recreation system that has been widely cited as an example for other cities.

Filter at Longmont sewage treatment plant. Digester with P.F.T. floating cover in background.

In addition to this income surplus there is available the depreciation reserve on the water and electric systems, which amounted to $57,900.01 in 1943. This sum

CITY OF LONGMONT POSTWAR CONSTRUCTION PLANS

Description of Project	*Site*	*Surveys*	*Plans*	*Specifications*	*Estimated Cost*	*Order of Construction*
Water Department						
1. Transmission main	Existing R.O.W.	Complete	Complete	Complete	$155,104	1
2. Distribution mains	City streets	Complete	Complete	Complete	104,689	3
3. Meter services	Private					
4. Rebuild filters	Filtration plant	Not needed	Complete	Complete	1,980	
5. Booster pump	Pump station	Not needed	Complete	Complete	970	
Electric Department						
6. Modernize hydro plant.....	Existing	Complete	Complete		59,065	2
7. Trans. line repairs.....	Existing R.O.W.	Complete	Complete	Not needed	6,000	4
Street Department						
8. Thicken bituminous mat.....	City streets	Not needed	Complete	Complete	24,000	
9. Seal coat	City streets	Not needed	Complete	Complete	12,000	
10. Widen Third Avenue.....	City streets					
11. Curb and gutter.....	City streets		Complete	Complete		
12. Sidewalk	City streets		Complete	Complete		
Sewer Department						
13. Replace defective laterals....	City streets					
14. New settled sewage pumps...	Disposal plant					
General						
15. Airport runways	Purchased 1944	Complete	Complete	Complete	36,750	5
16. Police & Fire building.....	Lots S. City Hall					
17. Swimming pool	Roosevelt Park					

Really Prepared for X-Day

Longmont, Colorado, has completed all the surveys, plans and specifications needed for abundant postwar projects, the sites are all owned, and the financing arranged for.

is fairly constant. Based on this study, it was decided that $100,000 annually could be used to finance needed improvements. As a cushion against years of low income, the city owns war bonds currently amounting to $150,000.

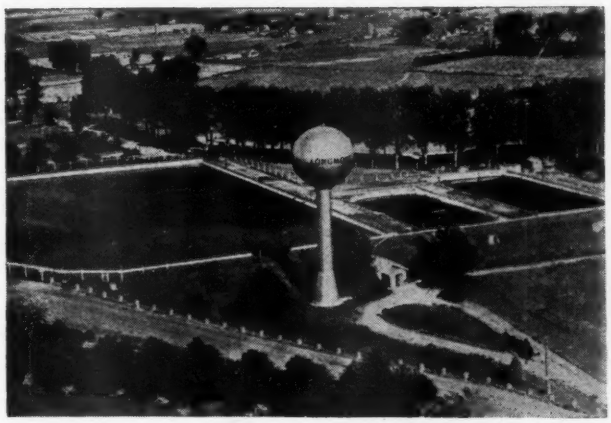
The next step consisted of listing all projects considered necessary or desirable within the next five years. The accompanying table gives a list of contemplated work and shows the status of our plans at this writing.

From this table, it will be noted that six items are considered for each project. The city owned sites or rights of way for every project except the airport. On July 11, 1944, the City Council voted to purchase 220 acres at a cost of $25,500 for the airport site. Field work is carried out in sufficient detail to provide information for drafting of plans, and bench marks and reference points permanently marked, from which construction stakes can be rapidly set. Specifications have been drawn to provide for competitive bids on several types of material and equipment. Cost estimates are arrived at through the use of current material quotations and contract construction prices, plus 10% for contingencies. They total about $400,000 for the entire program. The order of construction is determined, first, by the need for the project. second, by the ability of the city to finance the project out of current funds, and third, by the need for taking care of unemployment.

Concurrently with the plans for these projects, maps of the city utilities are being prepared. These serve two major purposes:

1. Provide accurate up-to-date information on utilities for normal and emergency use.

Longmont's diesel power plant.



100,000 gal. watersphere and 9,000,000 gal. reservoir.

2. Aid in planning new projects by showing locations and quantities of replacements and extensions.

The city property map was revised in 1941. Maps of the city and rural water distribution systems were completed in 1943, and a map of the rural electric distribution system has just been completed. Maps of the city electric distribution system, sanitary and storm sewerage are yet to be revised. All city maps are on a scale of 1 inch to 200 feet, and rural maps 1 inch to 1,320 feet.

Brief descriptions of the first five projects (in order of construction) follow:

1. Replace 15,403 linear feet of 30″ I.D. water pipe between the diversion dam and the hydro-electric plant. Most of this line is on the side of a mountain canyon and comparatively inaccessible, making for high installation costs. The original line is concrete and was constructed in 1911.

2. Install one 950 BHP turbine or impulse wheel direct-connected to a 750 KVA alternator to replace two 250 KW Pelton units at the hydro-electric plant. Original equipment installed in 1911. Project includes new penstock, switchboard and supervisory control, building changes and seven 250 KVA transformers, 11,000/2,400 V.

3. Replacements, enlargements and extensions to city water distribution system involving the following materials: 810 ft. of 2″ pipe, 550 ft. of 3″ pipe, 9,680 ft. of 4″ pipe, 21,800 ft. of 6″ pipe, 2,600 ft. of 10″ pipe, 2,600 ft. of 12″ pipe, 3,500 ft. of 14″ pipe, 39,450

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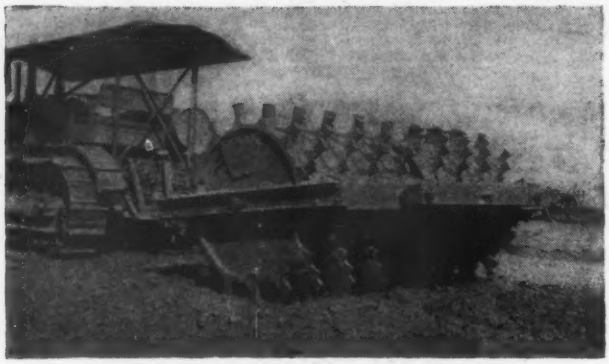


Sheepsfoot Roller Type B in Ohio.

Securing Optimum Con

CONTROL of embankment construction in accordance with laboratory compaction test data is a relatively recent development. The methods of performing both the laboratory tests and the field control tests vary with different organizations, but in all cases the test results disclose the relation between moisture content and density of a soil which results from a given method of compaction. A standard procedure for making the test for compaction and density of soil was adopted by the American Association of State Highway Officials in 1938 and by the American Society for Testing Materials in 1942.

This test discloses the moisture content of a soil at which the density obtained by a given method of compaction is higher than for any other moisture content. This is called the optimum moisture content. Greater stability of fills has been obtained wherever this test has been adopted as a basis for controlling compaction. However, many questions of importance arose in connection with its practical application.

Among these were the efficiency of different types of rollers in obtaining the desired results, the relation of the depth of layer to type of roller, the economics and limitations of moisture control, and the performance of the completed fill with respect to settlement and change in stability. In an effort to find answers to these questions, two cooperative projects, one by the State Highway Commission of Indiana and another by the Ohio Department of Highways, were undertaken, with the Public Roads Administration cooperating. The results of these have been combined in a report appearing in the July-August-September issue of "Public Roads," the official publication of the Public Roads Administration. The general nature of the methods of carrying out these projects and the conclusions from them are abstracted in the following article. The details of the procedures employed in making the tests have been omitted because of space limitations. Those wishing to make similar tests can obtain copies of the complete 26-page article from the Superintendent of Documents at Washington, D. C.

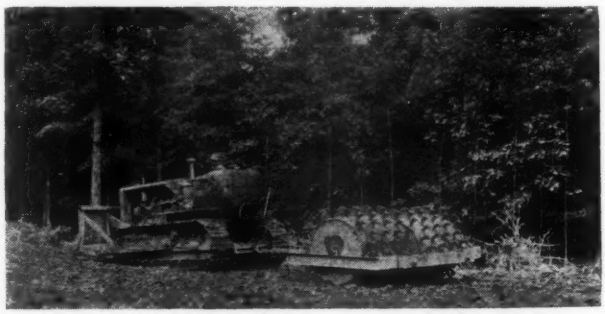
The Indiana project was conducted on about 0.8 mile of embankment on a flat, poorly drained area subject to inundation. This embankment was divided into 8 test sections, each 400 or 450 ft. long. The Ohio project follows the location of an old brick road for about 1.5 miles, the road grade being raised and widened. This was divided into 9 sections, each 450 to 700 ft. long. The treatment of these sections varied in the thickness of the layers of soil and in the type of roller used. In Indiana, sections 1, 2, 3 and 8 were spread to a loose thickness of 6″, sections 4 and 5 were 9″ and sections 6 and 7 were 12″. In Ohio, sections 1, 2, 3, 4, 8 and 9 were spread 6″ thick and 5, 6 and 7 were 9″.

On all sections of the Indiana project and sections 8 and 9 of the Ohio project, it was required that rollers compact each layer to a density equal to 95% of the maximum density of the soil as determined by the standard compaction test. On sections 1 to 7 of the Ohio project, it was required that each layer of soil be compacted to maximum density.

On section 1 of the Indiana project and all sections of the Ohio project, it was required that the moisture content of the layer at the time of compaction should be within 1 of the optimum moisture content of the soil used in the layer.

Three Types of Rollers Used

The compacting equipment included sheepsfoot, three-wheel, and pneumatic tire rollers. The sheepsfoot rollers were of two general types, A and B, with the dimensions, weights and working pressures as given in table 1. Common to both types were two drums, which rotated independently of one another. The drums were connected by a frame in such a manner as to permit the rollers to adapt themselves to uneven ground.



Sheepsfoot Roller Type A in Indiana.

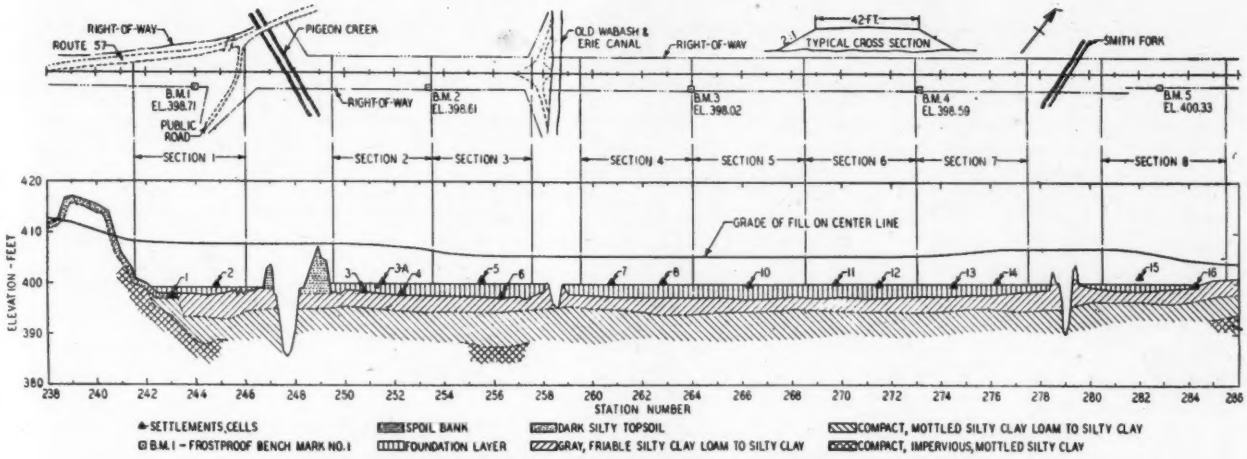
TABLE 1.—*Details of sheepsfoot rollers*

	Indiana, type A	*Ohio, type A*	*Ohio and Indiana, type B*
Number of drums	2	2	2
Diameter of drums (inches)	40	40	44
Length of drums (inches)	48	48	48
Distance between drums (inches)	10	10	8
Total width of tamped area (inches)	106	106	104
Number of feet per drum	88	88	112
Number of feet on ground	8	8	8
Length of feet (inches)	7	7	7
Tamping area of each foot (square inches)	5.5	5.5	5.25
Weight, drums empty (pounds)	5,100	6,250	7,350
Weight, loaded with water (pounds)	9,200	9,800	12,200
Ground pressure, drums empty (pounds per square inch)	116	142	175
Ground pressure, loaded with water (pounds per square inch)	209	223	290

Twenty-two rows of tamping feet studded each drum on type A rollers. Each row had four tamping feet so

Compaction of Highway Embankments

By use of compaction tests of the soils used, embankments were obtained that showed practically no after-settlement. Study of results obtained with different types and speeds of rollers.



Plan, Profiles, and Details of Experimental Section in Gibson County, Indiana.

located that they were staggered with respect to the feet in the adjacent rows. Each tamping foot had an enlarged elliptical contact surface of 5.5 square inches.

Type B had 28 rows of tamping feet. Each foot had a rectangular cross section with the longer dimension increasing with distance from the drum and the shorter dimension uniformly 1.5 inches throughout its entire length. The tamping feet were attached to a ⅜-inch removable circumferential band and could be replaced with feet of different sizes.

The three-wheel rollers weighed 10 tons each. The one used in Indiana had rear wheels 23 inches wide, producing a ground pressure of 325 pounds per inch of width.

The one used in Ohio had rear wheels 20 inches wide producing a ground pressure of 350 pounds per inch of width.

The same type of pneumatic tire roller was used on both projects. It consisted of a loading platform mounted on two axles equipped with nine smooth truck tires, four on the front axle and five on the rear axle. The tires on the front and rear axles were staggered with respect to each other so that they covered the entire strip, 60 inches wide, over which the roller traveled. The tires were inflated to a pressure of 35 pounds per square inch. The roller had a net weight of 2,680 pounds, but the platform was loaded so that under working conditions the roller gave a pressure of about 225 pounds per inch of width of tire surface in contact with the ground.

Three-Wheel, 10-Ton Roller in Ohio.

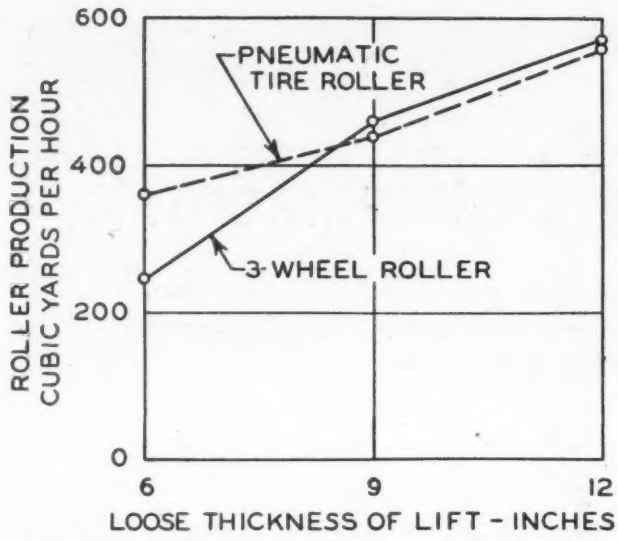
The required compaction was obtained with all these types of rollers. The average density and average number of trips by rollers of each type required to obtain compaction are shown in table 2.

TABLE 2.—*The average density and number of trips needed for compaction*

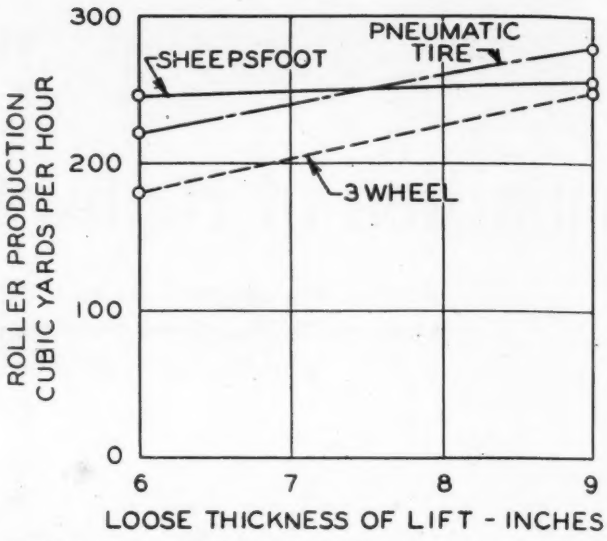
Roller type	Number Trips *Indiana*	Number Trips *Ohio*	*Maximum wet density in Indiana Percent*	*Maximum dry density in Ohio Percent*
Sheepsfoot	7.6	7.6	97.2	98.6
3-wheel	2.1	3.4	99.5	102.9
Pneumatic tire	3.1	5.1	98.1	102.9

Indiana Project.—The three-wheel and pneumatic tire rollers gave equal compaction with the same effort, regardless of whether the loose thickness of the lift was 6, 9, or 12 inches. The data disclose also that variations in average moisture content of the soil of as much as 5.5 above the optimum, and more than 7 in a few instances, did not increase the amount of rolling necessary to obtain the specified density.

Extreme cases of 18 trips with the sheepsfoot roller, 5 trips with the three-wheel roller, and 12 trips with the pneumatic tire roller were recorded. This occurred in only one instance with each type of roller and had little effect on the average values. As a matter of fact, the specified density was obtained with 6 or less trips on 69% of the lifts compacted with the sheepsfoot roller, with 11 to 13 trips on 24% of the lifts, and



Relation Between Lift Thickness and Roller Production in Gibson County, Indiana.



Relation Between Lift Thickness and Roller Production in Delaware County, Ohio.

with 8 or 9 trips on 5% of the lifts. Likewise, 2 or less trips were required on 88% of the lifts compacted with the three-wheel roller, and 3 or less trips on 88% of the lifts compacted with the pneumatic tire roller.

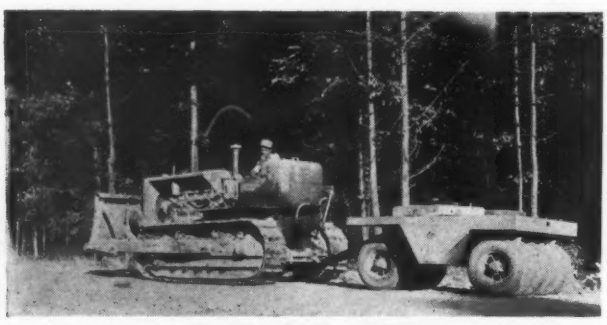
Several tests were made on section 6 to determine if there was any difference in density between the upper and lower halves of a 12-inch lift compacted by a three-wheel, 10-ton roller. The results of these tests, given in table 3, show that satisfactory compaction was produced throughout the entire thickness of the lift and that the lower half is likely to have a density equal to or greater than the upper half. The moisture content of the soils in this section ranged from 0.1 below to 4.7 above the optimum, and averaged 2.7 above the optimum. It has been observed that these relatively high moisture contents facilitate compaction of soils such as were found on this project.

TABLE 3.—*Results of density determinations on upper and lower halves of 12-inch lift compacted with 3-wheel 10-ton roller in Indiana*

Lift No.	*Station*	*Number trips with roller*	MAXIMUM WET DENSITY *Upper half Percent*	*Lower half Percent*
7	271+02	2	105.9	101.0
8	270+32	2	105.1	111.2
8	270+35	2	102.3	109.8
9	271+02	2	100.4	106.6

Ohio Project.—With the three-wheel and pneumatic tire rollers slightly more rolling was necessary on the 9-inch than on the 6-inch lifts in order to obtain equal compaction.

Extreme cases of 20 trips with the sheepsfoot roller and 8 trips with the three-wheel and pneumatic tire rollers were recorded. This occurred on only one lift in the case of the sheepsfoot roller and on three lifts with each of the other rollers. The construction records show that the specified density was obtained with 8 or less trips on 77% of the lifts compacted with the sheepsfoot roller, 4 or less trips on 74% of the lifts compacted with the three-wheel roller, and 6 or less trips on 93% of the lifts compacted with the pneumatic tire roller.



Pneumatic Tire Roller in Indiana.

The average densities of the compacted fills were very satisfactory. Although the minimum densities in some cases were considerably below the percentage specified, all lifts, with the exception of those in section 8, were compacted to a density of more than 90% of the maximum as indicated by the compaction test. Only three lifts in section 8 fell below this mark. These three lifts had densities equal to 83, 88.8, and 89.5% of the maximum.

Roller Production Discussed

Despite the fact that the required compaction was obtained by fewer trips of the three-wheel roller than by other types of rollers, higher production in cubic yards compacted per hour was obtained with the pneumatic tire and sheepsfoot rollers on the Indiana project where the fill material was placed in 6-inch lifts and on the Ohio project for both 6- and 9-inch lifts. Differences in width and speed of roller account for this.

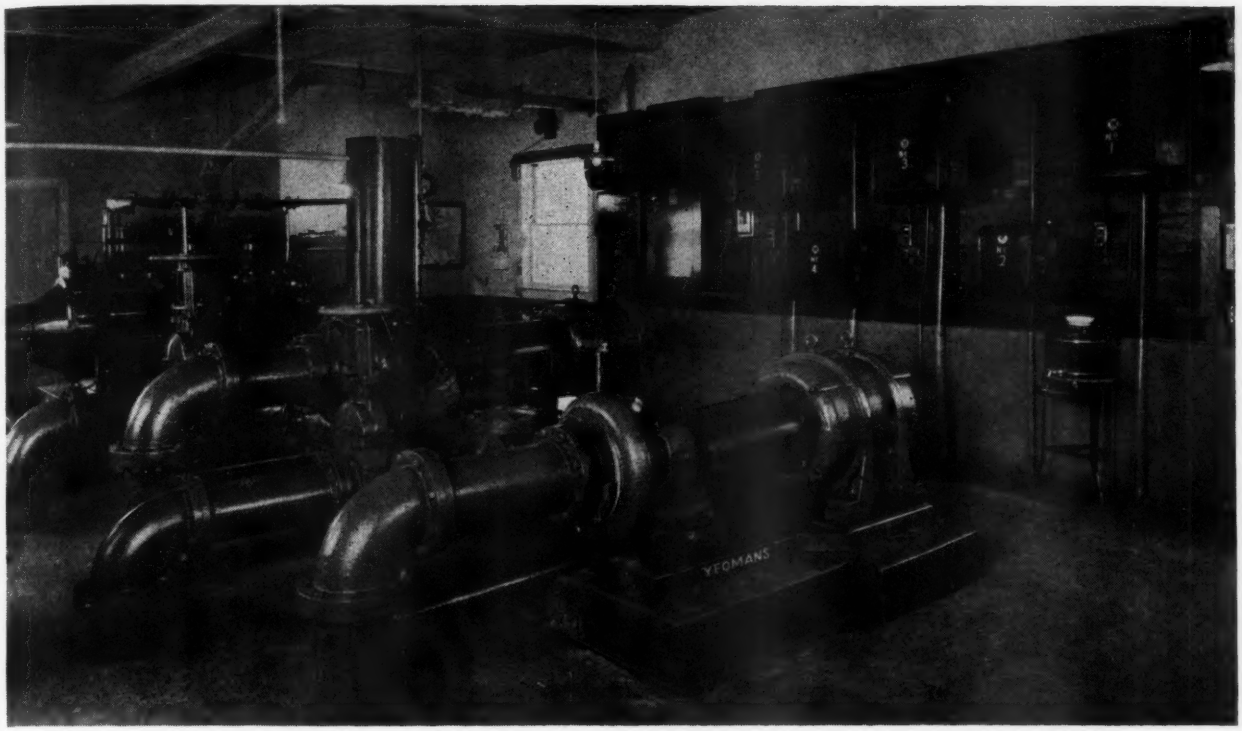
For example, sheepsfoot roller type A covered a strip 106 inches wide as compared with 60 inches for the pneumatic tire roller, while for the three-wheel roller the aggregate width of the rear rolls was 46 inches on the Indiana project and 40 inches on the Ohio project. At equal speeds the sheepsfoot roller could roll a given area once in 57% of the time required by the pneumatic tire roller, in 43% of the time required by the three-wheel roller in Indiana and in 38% of the time required by the three-wheel roller in Ohio.

Stated in another manner, at equal operating speeds the sheepsfoot roller could roll an area approximately 1.8 times as fast as the pneumatic tire roller, 2.3 times as fast as the three-wheel roller in Indiana, and 2.6 times as fast as the three-wheel roller in Ohio.

Speed of Rollers in Indiana Project.—The average speed of the sheepsfoot roller of 256 feet per minute on section 1 was the maximum obtainable with the 40-horsepower tractor used to pull the roller. This tractor did not have the power necessary to operate at a higher speed.

Speed of the pneumatic tire roller was influenced by safety considerations. The roller had a tendency to tip

(Continued on page 32)



Switchboard, the horizontal pumps and the gasoline engine on the motor floor of the Camp Croft pumping station. Starter No. 1 with its hand-off-automatic selector switch is for pump unit A. Starters No. 2 and 3 are for Unit B and starters No. 4 and 5 for Unit C.

High-Lift Sewage Pumping at Camp Croft

Vertical and horizontal pumps, coupled in series, lift 2,000 g.p.m. against a total head of 218 feet. Three units automatically controlled.

IN designing the sewerage system for Camp Croft, near Spartanburg, South Carolina, the topography imposed some unusual conditions. Concentrating all the sewage by gravity at one pumping station seemed desirable, but required pumping it against a static head of approximately 150 ft. through 12,000 ft. of 14" cast-iron force main. Also it placed the bottom of the dry well 21 ft. 6 in. below the operating floor on which the prime movers were placed if this were constructed (as it was) above high water level.

The plant was designed to handle a maximum flow of 2,000 gpm, although the wet well was made of such size as temporarily to store occasional flows in excess of this for a few minutes. The plant also provided for handling flows considerably less than this by providing pumping units of three different capacities—700 gpm, 1,400 gpm and 2,000 gpm.

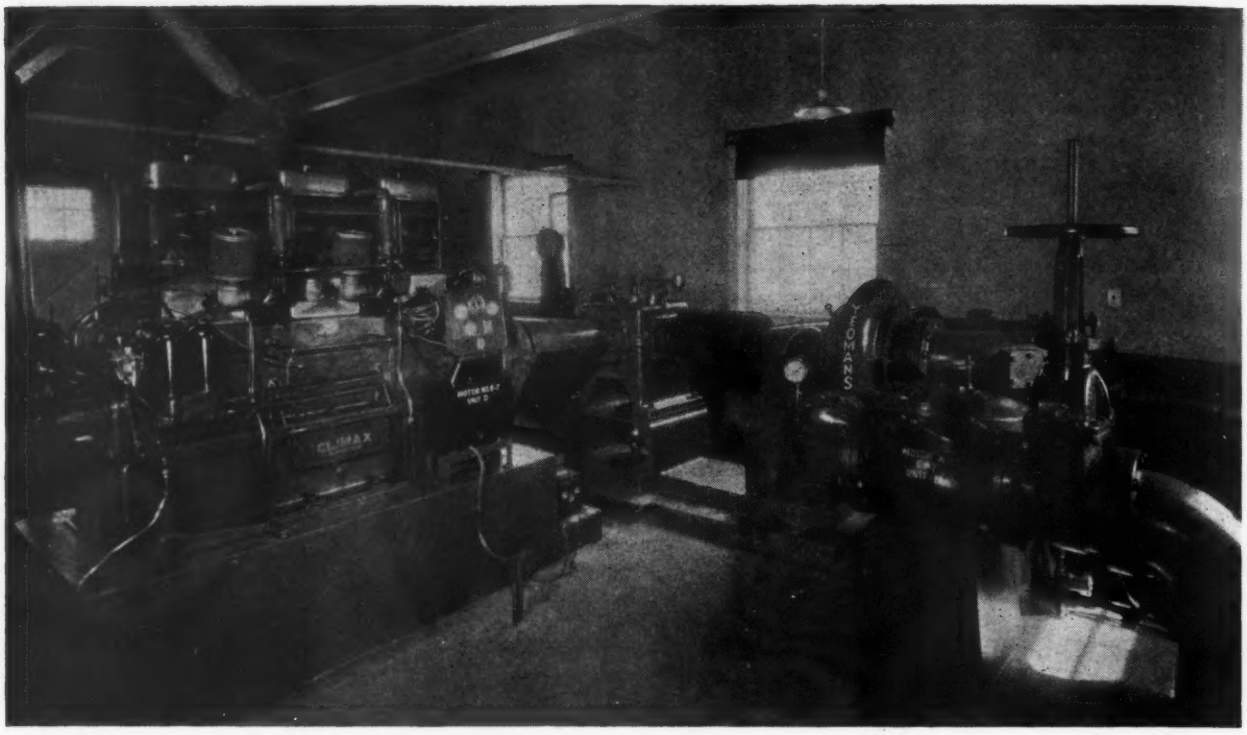
The 700 gpm unit consisted of a vertical, non-clogging, ball-bearing pump designed for 166 ft. total dynamic head, direct connected by flexible shafting to a 50 hp 1,750 rpm, 3 phase, 60 cycle, 440 volt vertical motor. This unit, called Unit A, operates until the sewage in the wet well reaches a depth of 8 ft., when Unit B cuts in automatically and Unit A cuts out.

Unit B, capacity 1,400 gpm, consists of a vertical pump and motor and a horizontal pump and motor, operating in series, 45 ft. head being developed by the vertical pump and 140 ft. additional by the horizontal pump, the former discharging into the suction of the latter. The vertical pump is similar to that of Unit A and is direct connected by flexible shafting to a 25 hp 1,150 rpm vertical motor; the horizontal pump is a non-clogging, ball-bearing type driven through a flexible coupling by a 75 hp 1,750 rpm horizontal motor.

Should the sewage reach a depth of 10 ft., Unit C, of 2,000 gpm capacity, cuts in and Unit B ceases operation. Unit C consists of a vertical and a horizontal pump in series, similar to Unit B, both vertical and horizontal motors being 75 hp 1,150 rpm and each pump developing 109 feet head, or a total dynamic head of 218 ft.

As the sewage falls, this sequence of operation is reversed, all pumping stopping when the depth of sewage in the wet well falls to 2 ft. 6 in. This automatic control program is actuated by a single float, each motor being equipped with an automatic auto-transformer type reduced-voltage starter with a "Hands-Off-Automatic" selector switch. Each pair of starters are so set as to be energized simultaneously by the control, but so that the vertical pump will start slightly in advance of the horizontal pump.

There is also a stand-by Unit D, in which the pumps



Motor floor of the high-lift sewage pumping station, showing gasoline engine attached to a right angle gear drive, the vertical shaft of which is connected to a vertical pump on the floor below. The horizontal shaft is shown connected to a horizontal pump on the right of the photo. This arrangement makes possible the operation of both pumps by the one engine.

are similar to those in Unit C, but are driven by a 190 hp 1,150 rpm fully automatic horizontal gasoline engine, which is connected through horizontal flexible shafting and couplings to a right-angle gear drive for one-to-one ratio. The vertical shaft of the gear drive is connected through flexible couplings and shafting to the vertical pump, and a horizontal shaft to the horizontal pump. This unit has a rated capacity of 2,000 gpm against 218 ft. total dynamic head. The automatic control for the gasoline engine includes the necessary electric relays, automatic choke and spark adjustment to start the engine automatically. Dual ignition, cold water tempering tank, excess jacket water temperature cutout, low oil pressure cutout, and over-speed trip device are included in the engine equipment.

All of the vertical motors are equipped with box boss standards so as to raise the motors off the floor and allow access to the upper flexible couplings for alignment check from this floor. All pumps are equipped with cast iron impellers capable of passing solids ranging from 3 inches for the 700 gpm pump to 5 inches for the 2,000 gpm unit.

Normal drainage of the dry pit pump floor is handled by two 20 gpm "Drain-Dri" pumping units, which are installed in suitable sump pits. For emergency operation, the sump pits are emptied by Unit D, whose suction is provided with pipe, small check valve and extended stem valve, and connected to the sumps.

All of the above pumps are Yeomans Brothers make, the gasoline engine is a Climax, and the motors are Howell; the entire pumping equipment being furnished by Yeomans Brothers Company, whose erection engineer, E. Wheelhouse, supervised and checked the installation and testing. The Harwood Beebe Company, consulting engineers of Spartanburg, designed the pumping station and supervised its construction.

Adjustment of Damages and Benefits From Sewage Disposal Plant

In an action against a town for the destruction of an easement appurtenant to the plaintiff's land, consisting of the right to use a private beach on Long Island Sound adjacent to plaintiff's lot, by the erection of a sewage disposal plant on lots condemned by the town for use in connection with its new sewer system, the town appealed from a judgment for plaintiff fixing the damage at $800 on the ground that the plaintiff sustained no damage, and that the plaintiff's lot had been benefited rather than damaged by the establishment of the plant. The Connecticut Supreme Court of Errors affirmed the judgment of the trial court which held that the value of the plaintiff's land had been decreased $1,300 by the defendant's establishment of the sewage disposal plant in violation of the provision of the plan of the development of which the lots formed a part restricting the use of all lots to residential purposes only. The trial court further found, however, that the fact that the plaintiff could connect with the sewer running to the plant, relieving him of the expense of building a septic tank for the disposal of sewage upon his property, resulted in a saving to him of $500, bringing the net amount of his damage to $800, the amount of the judgment.

Vitrified Sewer Pipe Prices

OPA announced on July 19 an increase of 11.4% in manufacturers' present maximum prices of vitrified clay sewer pipe and allied products produced in Iowa, Minnesota, North and South Dakota and western Wisconsin. This is the minimum amount determined necessary to eliminate current losses for the four producers in this area and return them average aggregate earnings comparable to those of 1936-1939.

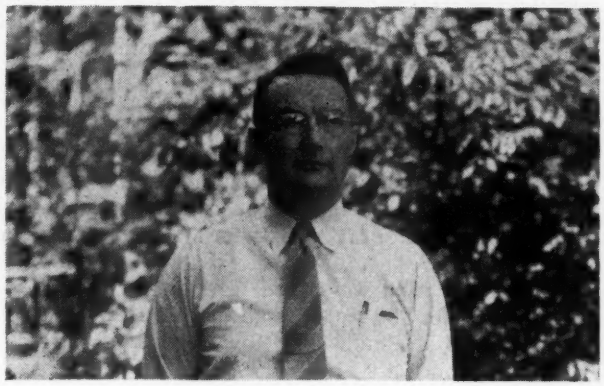
Maintaining a Village Water Tower

Painting the inside of the tank made unnecessary by installing cathodic system. Contracting for painting the outside and the tower had its headaches.

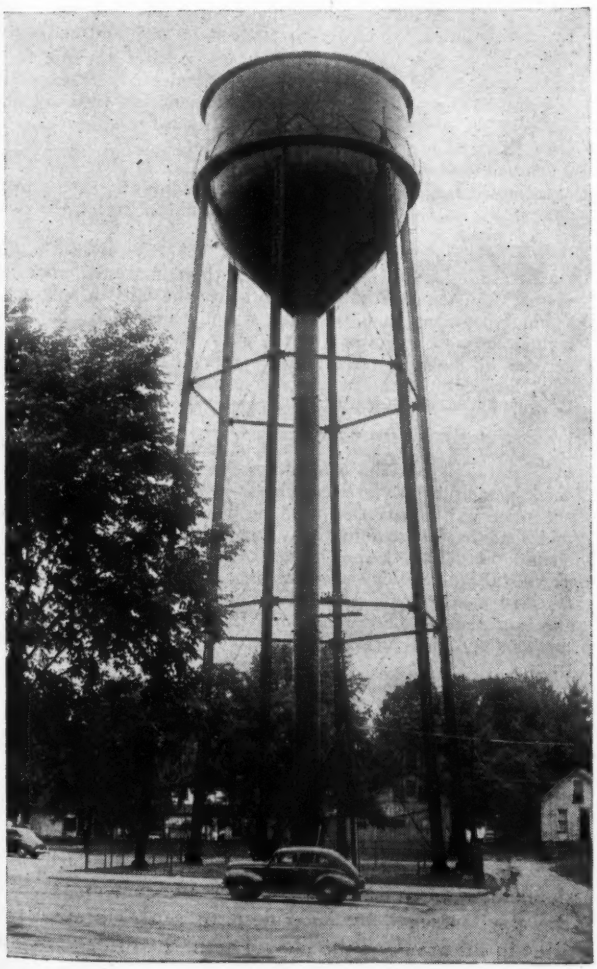
By R. W. SHOEMAKER
City Manager, Westerville, Ohio

WESTERVILLE, Ohio, has a 200,000-gallon water tank on a 130-foot tower which had received no attention in the way of maintenance since the middle 1930's (and was advertising that fact) until the summer of 1943, when it was decided to clean and paint it in spite of the war, manpower shortage and other handicaps. The scarce heads on the numerous tower maintenance circulars had made us particularly aware of our responsibility for an elevated tank in a closely built-up district. According to these circulars, to maintain and make safe a tank was very simple provided the work was placed in the hands of certain contractors.

During the early part of the year we installed a cathodic system of rust prevention inside the tank. This made further inside painting or other maintenance unnecessary; our experience has been that little paint is left on the inside after two winter seasons, due to the scouring action of floating ice.



R. W. Shoemaker, City Manager.



Westerville's water tower.

In preparing for painting, our first job was to prepare a combined bid and acceptance form, including specifications for the work to be done. This was sent to a group of several firms who had sent us circulars or letters during the past several years stating that this was their business. Most of the forms were returned either properly filled out or giving reasons for not bidding. A representative of one tank maintenance firm called at our pumping station almost immediately after the bid forms were mailed. On being told that he must see the City Manager he remarked that if the town had a manager his firm was not interested in the job. However, he did look the job over and interviewed the City Manager. Scarcely looking at the prepared specifications he produced his own contract form, filled in a price and tendered it for approval. This contract called for one coat of an unspecified paint instead of two. Also much was made of a clause covering cleaning out the tank and testing for public safety. Questioning brought out that "cleaning out" entailed the removal of sediment in the bottom of the riser pipe, and that "testing for public safety" was done by examining and replacing rivets or other structural members which the contractor deemed unsafe. Further conversation and questions developed that there were unit prices for the replacing of rivets, etc., but these were not listed in the contract; also that most tanks cleaned and painted had considerable structural repairs to be made.

In this connection we wrote six towns and villages which had had recent repairs and found that extras or structural repairs ran from none up to $6,008.85; the average extras on four jobs reporting such being $2,633.46. Most of the cities reporting expressed sat-

isfaction, except the one having the lowest extra cost of $450, which was considered excessive. Two of six reports contained the remark that a local inspector should be employed.

All bids received at this time were rejected and, after some minor changes in the specifications, new bids were asked for and a contract let. Of the first set of bids received, the above described bidder was well less than one-half of the next low bid; but he did not bid on the second advertisement.

Considerable scraping and wire brushing were necessary. The structural supports of the tower were in much worse condition than the tank and riser pipe. (If rust and paint scaling have progressed to any serious extent, some engineers recommend sand blasting followed by an application of a rust inhibitive, then an undercoat and finish coat of a good paint. This gives a smooth new-like appearance to any metal equipment.) Most of the paint was applied with compressed air.

Scaffolding was improvised, and the usual ropes. pulleys, horizontal ladders and bo'sun chairs used. A 105 cfm Schramm compressor capable of operating five spray guns, together with enough air and fluid hose to reach any place on the operation, completed the equipment. The spray guns were of the external mix type.

The paint used was a red lead undercoat and carbon black No. 930 finish, both as put up by the Arco people in Cleveland. The finish paint consisted of 2½% carbon black and 97½% all spar varnish vehicle. This paint and method of application gave results which so far seem to be satisfactory.

The following bid form and specification was prepared by the writer for our particular job. This might not meet the needs of another municipality, but we are presenting it herewith in the belief that it may be of help as a guide for smaller communities which do not have an engineering department to prepare such documents.

Specifications for Painting a 200,000-Gallon Water Tank and Tower in the Village of Westerville, Ohio

A. *Scope of Work.*

1. This contract shall consist of furnishing labor, paint material, tools, scaffold, rigging, platforms and all other equipment as may be necessary to clean and paint the entire exterior of the Municipal Water Tower from the extreme top to the concrete foundations. This shall cover all exposed exterior metal work of every description including the tank, standpipe, supports, braces, ties, brackets, railings and all other metal work whether specifically mentioned or not. The interior of the tank cover and interior sidewalls down to the overflow (approximately two feet below the square of the tank) shall also be cleaned and painted.

2. *Cleaning.*—All loose, cracked and scaling paint shall be scraped off and the exposed metal thoroughly wire brushed, leaving the surface free of loose paint and/or rust scales. Dust shall also be removed before painting.

3. *Painting.*—Apply one overall coat of red lead and, after allowing to thoroughly dry, follow with one complete coat of Detroit Graphite Paint or equal. Manufacturer's directions shall be carefully followed in the mixing and use of paint. Workmanship shall be of the best known to the trade.

4. *Size of Tank.*—200,000 gallon capacity with maximum elevation about 120 feet above ground level.

5. *Location.*—On East Main Street near the CCC Highway, Westerville, Ohio.

6. *Inspection of Project.*—All bidders are requested to examine this project and inform themselves of the present condition and design.

7. *Samples* of paint material shall be submitted and approved before start of work. All samples shall be submitted in the manufacturer's containers and shall include full directions for use.

B. *Inspection.*

1. The City Manager or his authorized representative shall at all times have access to this operation for purposes of inspection of the work or consultation with the Contractor. Any discrepancies, omissions or poor workmanship in either cleaning or painting called to the attention of the Contractor shall be immediately corrected.

2. Any structural faults or parts noted by the Contractor to be in need of repair shall be called to the attention of the City Manager. The Village reserves the right to enter upon the property to make any essential structural repairs during the course of this contract.

C. *Time of Completion.*

Unless otherwise approved, the Contractor shall enter upon and start the work of this contract within fifteen (15) days after notice of the award. The work shall be prosecuted continuously thereafter until completion, which in no event shall exceed sixty (60) days. Sunday work will not be permitted.

D. *Contractor's Responsibilities.*

1. The Contractor shall at all times maintain a qualified and experienced superintendent or foreman and labor on this operation.

2. He shall assume full responsibility for the protection of his employees and the general public from personal injury or property damage.

3. He shall file with the City Manager certified or photostatic copies of his Workman's Compensation Certificate.

4. He shall file with the City Manager a certified copy of his public liability insurance which shall be in a minimum amount of $10,000/$20,000.

5. He shall protect his work from accident or the elements and, if so directed, replace any damaged or defective work at his own expense.

6. He shall provide necessary sanitary arrangement for his workmen.

7. The Contractor shall execute a bond for the sum of Two Hundred Dollars ($200) for the satisfactory performance of this contract. This bond shall be in a form acceptable to the City Manager and must be signed by the Contractor and the Sureties.

8. The Contractor shall be subject to all laws and ordinances of the Village of Westerville, within which Village this agreement is to be fulfilled, and the Contractor shall be entitled to no exemption therefrom on account of this contract.

9. If the execution of this contract requires the use of the public streets or sidewalks, the Contractor shall be responsible for the placing and maintaining of barriers, red lights or other devices. No streets shall be closed without the approval of the City Manager.

E. *Payments on Contract.*

Intermediate payments on the contract may be made to the Contractor on the first or tenth of the month during the course of the work.

Intermediate payments shall be at the request of the Contractor and shall be in accordance with estimates of work completed. All estimates shall be made by the City Manager.

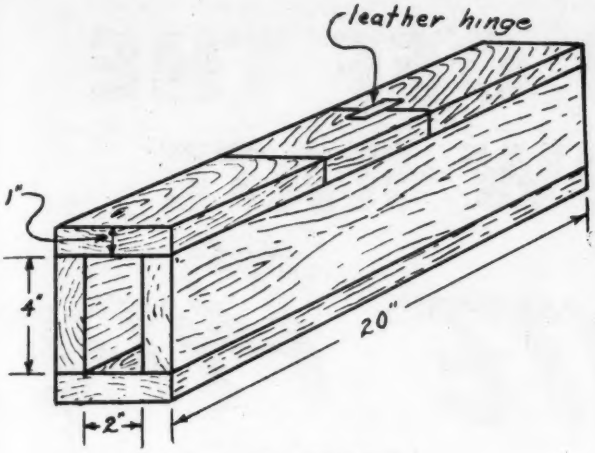
Final payment shall be made within thirty (30) days after completion and acceptance of the work, provided the Contractor certifies all labor, material and/or rentals have been paid in full.

F. Sealed bids will be received at the City Manager's Office, Westerville, Ohio, until 12:00 o'clock noon Eastern War Time, _____, 194___. The bid must be signed by an officer of the Company or Firm making the bid and shall contain the address in full. Each bid shall be accompanied by a certified check in the amount of 10% of the price bid. This check shall be drawn to the City Manager and shall be forfeited to the Village of Westerville as damages, should the bidder selected refuse to accept the contract. All unsuccessful bidders will be notified and their checks returned. The certified check of the successful bidder shall be returned upon the execution of the contract and the posting of the bond hereinbefore specified for the satisfactory performance of the contract.

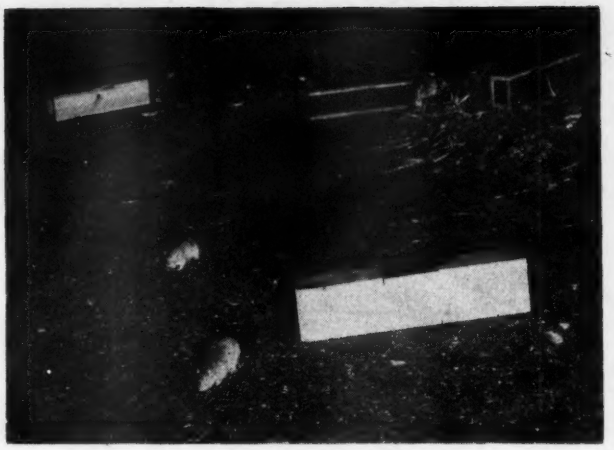
The Village, through its City Manager, reserves the right to reject any or all bids.

Traffic Study at New Orleans

The Public Roads Administration, the Louisiana State Highway Department and local municipal agencies are making a joint traffic study at New Orleans to determine the travel habits and traffic concentration on the city's streets, by interviewing representative families in all areas of the city. The field studies are practically completed and the data are now being compiled.



Construction of bait box.



A flash of poison bait stations at night.

Rodent Control at Fort Devens, Massachusetts

Garbage dumps harbor rats, which spread diseases. How army engineers exterminated rats, to the estimated number of over 3,000, told in detail.

By **GEORGE J. COOGAN**
Captain, Sanitary Corps

IN February, 1944, an examination was made of the Post dump at Fort Devens for the purpose of observing the type of material going to the dump and its method of handling. The introduction of sanitary fill was under consideration at the time. During the examination it was noted that rats were scavenging on the face of the dump. The face is about thirty feet deep and has approximately a forty-five degree slope which is maintained throughout its entire depth by varying the point of dumping each day.

About thirty rats were noticed feeding on the dump during the daytime and since they are essentially nocturnal animals, it was estimated at the time that for every rat visible during the day, there may be fifty others present, indicating that a considerable rat population existed on the dump. As a result of these observations it was decided that some rodent extermination should be done and poisons were ordered and information gathered for a full scale program of extermination.

Three or four nights after the initial observations, a fire broke out on the face of the dump. The fire department was called and as the fire trucks entered the area, the headlights lighted up the top of the dump and showed so many rats running up from the face that some of the men feared to get down from the fire trucks. The comments of members of the fire department were that the dump was a "moving mass," that the ground "moved in waves," that "at least five or six thousand rats were on the top of the dump alone." Observations were made for several nights and it was concluded that thousands of rats actually did exist at the dump and that the estimates had not been grossly exaggerated.

As a first step in the extermination program the advice of the Division of Predator and Rodent Control of the U. S. Department of the Interior, Fish and Wild Life Service in Massachusetts, was sought and a preliminary survey was made which indicated that there might be a rat infestation on the built-up area of the Post itself. Consequently, it was decided that a complete survey should be made which would include every building on the Post and some areas adjacent to the military reservation. Due to the size of the Post, such a survey would require a large group of men who would have to be trained in rodent detection methods. The services of an enlisted man with previous civilian experience in rodent control methods with the Division of Predator and Rodent Control were obtained, and a crew of twenty enlisted men from the Medical Sanitary Companies was assigned to the project. All of the men had been trained previously as sanitary technicians by Sanitary Corps officers. Lectures were given and conferences held with the men to acquaint them with the problem and the methods to be followed. This crew of twenty men was divided and groups assigned to various areas on the Post, and the exterior of each of the 1680 buildings was examined for the rat burrows, and where indicated, the interiors of buildings were examined. As a further check, a notice was published in the Daily Bulletin requesting information on any rat infestations noted by other personnel on the Post.

When the building survey had been completed, it

NO TUBERCULATION TO CHOKE OFF THE HIGH FLOW-RATE of TRANSITE PIPE!

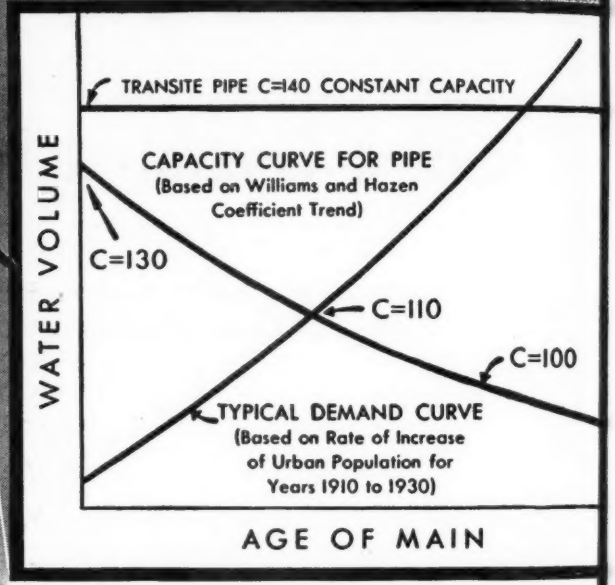


Chart shows how high initial flow rate combined w maintained carrying capacity account for one of the imp tant advantages gained through the use of Transite P

HERE'S a pipe whose delivery capacity never be affected by tuberculati Johns-Manville Transite Pipe has this valu advantage because it's non-metallic, being m of asbestos and cement.

In addition, Transite Pipe has a smooth, cl grained interior surface that offers less resist to water-flow, resulting in an unusually h initial flow rate.

Other advantages you get with J-M Tran Pipe are rapid, simple assembly and tight, flex joints because of the Simplex Couplings; and handling due to its light weight.

* * *

For more details, write for Transite Pres Pipe Brochure TR-11A, Johns-Manville, 22 40th Street, New York 16, N.Y.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville TRANSITE PIPE

An asbestos product for efficient, economical water and sewer lines

FORT DEVENS FEBRUARY 1944

LOCATION	TYPE OF FOOD	27	28	29
STA #1 Bldg 2093	M	C	C	C
	F	PT	PT	NT
	C	NT	NT	NT
STA #2 Bldg 2090	M	NT	C	C
	F	PT	NT	NT
	C	NT	NT	NT
STA #3 Bldg 2089	M	C	PT	C
	F	NT	PT	PT
	C	NT	NT	NT
STA #4 Bldg 2062	M	C	C	C
	F	NT	NT	NT
	C	NT	PT	PT
STA #5 Bldg 2058	M	PT	C	C
	F	NT	PT	PT
	C	NT	NT	NT
STA #6 Bldg 2048	M	C	C	C
	F	NT	PT	PT
	C	NT	NT	PT
STA #7 Bldg 2028	M	PT	PT	C
	F	NT	PT	NT
	C	NT	PT	NT
STA #8 Bldg 2024	M	PT	C	C
	F	NT	NT	NT
	C	NT	NT	NT
STA #9 Bldg 2018	M	PT	PT	PT
	F	NT	NT	NT
	C	NT	NT	NT
STA #10 Bldg 11	M	NT	PT	PT
	F	PT	PT	PT
	C	NT	NT	NT

Fig. 2—Record of the results of test baiting.

was known just where the rats were to be found. A large map showing each building on the Post was prepared, and all buildings where evidence of rat infestation was found were bordered in red.The infestation at the dump was much more serious than in the buildings on the Post.

Due to the large rat population, it was decided that poisoning would be the best method of control. This method has its accompanying hazards such as chance poisoning of pets or inadvertent transportation of bait, but these were minimized by the use of bait boxes. (See illustration.) Small openings permit a rat to enter either end but are too small for a cat or dog to reach the bait, which was placed between two wooden cleats in the middle of the box by opening the leather-hinged cover on the top of the box.

Test-Baiting

To determine what type of food would be accepted readily by the rats it was decided to test-bait. Approximately one hundred bait boxes were set out at buildings or stations indicated in red on the map and also at the dump. Fresh carrots, fish, and ground beef scraps were used in test-baiting. Test-baiting was carried on for three nights, all three types of baits being placed in each bait box each night.

To carry on properly a rat program, accurate records must be kept. Each area to be test-baited was assigned to two men and they were made responsible for record-keeping in their area. The purpose in using two men was that, should one man not be available, the other would know where the bait stations were located and how to keep records in the notebook. A non-commissioned officer was assigned to supervise the project as a whole. It was his job to make sure that the work was properly done, records were properly kept, and to check the men to see that each bait station was being examined. It cannot be overemphasized that conscientious and dependable men must be used.

Figure #2 shows the method of keeping a record of the results of test-baiting. On the first day, sufficient meat (M), fish (F), and carrots (C) were placed in each of one hundred bait boxes to fill approximately one-fourth of the capacity of the middle portion of the bait box. In the morning the boxes were examined and note made if the bait was cleaned out (C), partly taken (PT), or not taken (NT). Separate note was made of each type of bait for each of three nights, and at the end of three nights it was obvious that meat was the most acceptable food, and therefore, the bait to use.

Pre-Baiting

The purpose of pre-baiting is to train the rats to come to a definite fixed place where food is obtainable; also to determine how much food will be eaten by those that have established an eating habit at that station.

Three hundred bait boxes were used about the Post and at the dump, at the spots where rats were found by the survey, 200 boxes being placed at the dump. All were numbered and labeled "Poison."

On the first night of pre-baiting, ground beef was used, approximately one-quarter of a pound in each bait box, or a total of ninety pounds. The following morning, each bait box was observed to determine acceptance of the bait. A record was kept of the amount taken as shown in Figure #3. Each vertical column represents a given date, and the sequence of baiting at each station is indicated on a horizontal line. Cross hatching was used to indicate the proportionate amount of bait used on any particular date; if the box was filled one-quarter full, one-quarter of

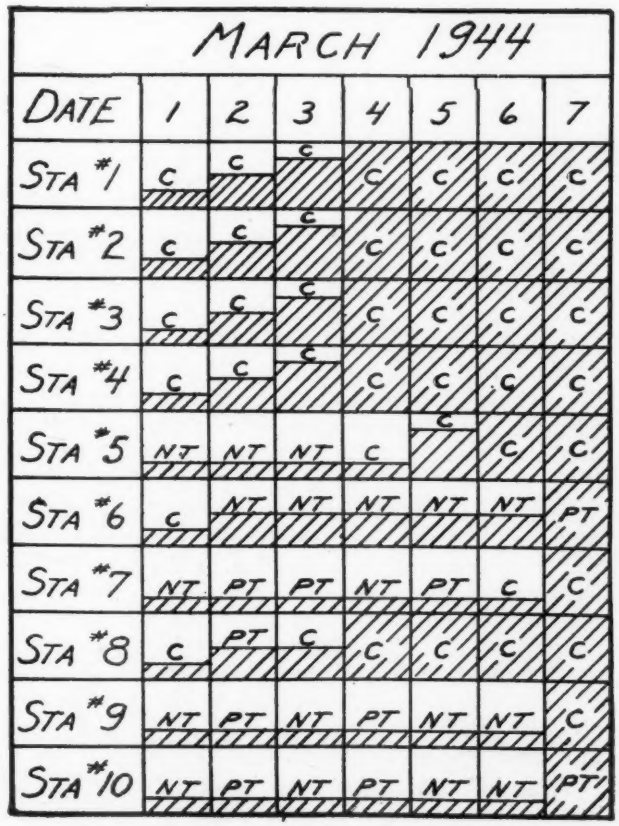


Fig. 3—Record of the amounts taken from the bait boxes.

the space was shaded. If the bait was cleaned out the first night, the letter C was placed above the horizontal line. On the following day the amount of bait was increased to one-half the capacity of the bait box. If this was accepted the second night, the amount of bait was increased to three-fourths of the capacity of the bait box; and if this was accepted on the third night, the box was filled to its capacity and kept filled until the night of poisoning. This is shown on the shaded areas in successive squares.

Station #5 exhibits one type of condition. The bait was not accepted the first, second, or third nights. (This box, the same as all others, was filled to one-fourth its capacity.) When the bait was not accepted the first night, no new bait was added and the same bait was left in the box for the second and third nights. On the fourth night, the bait box was cleaned as indicated. On the fifth night this box was increased to three-fourths of its capacity, and on examination the following day, it was found that the box had been cleaned. On the sixth night, the box was filled, and it was found on the seventh day to be cleaned. Poisoning was done the seventh night.

Station #7 exhibits another condition. The bait was not taken the first night. On the second night it was partly taken. Enough new bait was added to make up the one-fourth capacity of the bait box, and on the third night it was partly taken again and similarly only the amount taken was added to make up the one-fourth capacity of the box. On the fourth night, the bait was not taken at all. No new bait was added. On the fifth night it was found that the bait was partly taken, and as before, bait was added to make the bait box one-fourth full. On the sixth night, the box was cleaned. On the seventh day, the box was filled to its capacity, and on the eighth day it was found to be cleaned. Poisoned bait was used on the seventh night. Poisoning can be resorted to on the first night, but a study of Figure #3 shows that it would not be too successful. The same applies for the second and third nights.

Why some boxes were not touched or only partly taken may be explained by the fact that some garbage would invariably reach the dump.

The use of pre-baiting at the dump was in competition with the garbage arriving at the dump. The Norway rat is a scavenging type that will eat anything and, having been used to garbage, is not easily diverted from his customary eating habits. If pre-baiting was continued for twenty or thirty days, it is quite possible that all rats would be coming to the bait boxes. Economically, this is not desirable due to the fact that meat was used. The use of beef was discontinued and horsemeat substituted in pre-baiting when it was found that a large amount would be needed. Horsemeat was found as acceptable as beef if not more so.

The fact that some bait boxes were cleaned on the fourth and fifth nights and then not taken on the sixth and seventh nights may be due to the rats finding meat or garbage deposited on the dump which was just as acceptable as the meat in the bait boxes. If no garbage had been permitted to be deposited at the dump and all garbage already there had been covered with from six inches to a foot of ashes, no difficulty would be experienced in training the rats to come to the bait stations.

Those bait boxes placed at the Post from which no bait had been accepted were taken up on the night of poisoning and brought to the dump where the major infestation was located. The bait in approximately one hundred bait boxes at the Post had been partially taken or cleaned entirely during the pre-baiting campaign, and these boxes were left there.

General Condition of the dump.

Due to the construction of the bait boxes it is reasonable to assume that only rats were feeding on the bait. It was noted that dogs and cats tried to get into the bait boxes but were unsuccessful. There are some mink and skunks on the Post but the skunks could not enter the box and the mink would not accept the type of bait used. There is no reason to believe that mice were feeding at the bait boxes.

Two hundred bait boxes were to be set out at the dump. These were to be placed on the top, face, and bottom of the dump, and in the runways to burrows. It was decided to poison on the seventh night because it was felt that the maximum number of rats were feeding at the bait boxes by that time. Nearly the same amount of bait was taken on the fifth and sixth nights.

Prior to poisoning, a notice was placed in the Daily Bulletin warning all personnel on the Post to restrain pets for a period of forty-eight hours. This precaution was taken because it was found that some bait boxes had been tampered with. In fact, fifteen of them had disappeared entirely along with the bait in them, even though they had been clearly marked "POISON" in red. It would be possible that should the same thing happen on the night of poisoning, the bait would fall onto the ground and any animal that ate it would be killed. Each full station contained enough poison to kill four dogs.

The poison used was zinc phosphide, 2 pounds of which was mixed with 200 pounds of horsemeat. The zinc phosphide was obtained from the Division of Predator and Rodent Control. Its chemical composition is zinc 71%, phosphorus 21%, and inert ingredients 8%. It is a dark gray, lustrous or dull powder. It may be obtained as a very fine powder or dust or in the form of a flux for ease in mixing. It has a faint phosphorus odor, is insoluble in water, and must be kept dry. It also deteriorates with age. It is very dangerous to use due to the fact that it may be absorbed directly through the skin. Rubber gloves were used to mix the zinc phosphide flux with the meat, which required two men working about four hours. The horsemeat was ground up to hamburg form and about 20 pounds added to each of 10 metal pails. The zinc phosphide was added to each pail and thoroughly mixed with a stick held in rubber gloved hands. All mixing was done in the open. The pails of poisoned

(Continued on page 46)

A. C. Leonard, County Engineer.

Making Maintenance Earn Its Keep

Us of calcium chloride reduced an annual loss of 200 to 250 cubic yards of limestone surfacing to 25 to 50 yards, and much less blading is needed.

By A. C. LEONARD
Olmsted County (Minn.) Engineer

THE experience of the Highway Department of Olmsted County, Minnesota, during the war years is perhaps typical of other county departments. With construction out for the duration and materials and labor curtailed and equipment shortages ever present, we had to re-examine all our practices in an effort to give the public the best riding surfaces possible despite these restrictions.

We have 324 miles of road in Olmsted County which we try to keep in condition adequate to carry the traffic. We had been using graded limestone on our roads for surfacing and trying to select a gradation which would give us a reasonable amount of stability after it had been traffic-bound. Our figures, however, showed that we were losing from 200 to 250 cubic yards of limestone surfacing per mile each year. At the present time, crushed limestone laid on the road costs us at least $1.50 a yard, and it can readily be seen that such maintenance is a costly procedure.

In 1942 we started a program of maintaining these limestone roads with calcium chloride with the goal of saving some of this loss. That year we treated 35 miles and in 1943 we added 33 miles, and we are again treating these 68 miles this year. Loss of limestone has been reduced greatly by this treatment, the calcium chloride providing a moisture bond which keeps the fines in the surface. I don't know exactly how much the loss has been reduced, but it seems to me from inspections I have made that the loss has been cut from 200 to 250 cubic yards per mile per year to between 25 and 50 cubic yards per mile. If I saved only 150 cubic yards per mile, this treatment would be saving more than $200 a year per mile in surfacing material alone.

Condition of a treated road after an unusuallly hard winter.

Calcium chloride-treated road near Rochester, in Olmsted County.

The importance of sufficient fines impressed me when I inspected our roads this spring. The small amount of float on the surface was found to be composed almost entirely of material in excess of ⅜ inch. To me this meant that there was not sufficient binder material in the road. I have been experimenting with the addition of an equal or greater amount of agricultural lime to the float as a binder material. This added limestone is minus 3/16 inch in size and, when mixed with the plus ⅜ inch material and treated with calcium chloride, provides a denser wearing surface, with less tendency toward pitting and ravelling.

Our first treatment on the road averages six tons of calcium chloride to the mile. The second treatment is three tons to the mile. After the first year, we usually give 3-ton treatments twice a year. One can tell easily when treatment is needed; as soon as the dust starts to fly and the road is losing those valuable fines, it is time for supplying the moisture bond furnished by calcium chloride.

Saving of the limestone is only one of the ways in which this treatment helps maintenance operations. Our experience has shown that much less blading is needed on calcium chloride-treated roads. Where before we usually bladed a road once or twice a week, we now blade it only once or twice a month. In early spring, it is our practice to blade rather heavily to obtain proper crown and riding surface. The rest of the year

(Continued on page 44)

When you need special information—consult the classified READER'S SERVICE DEPT., pages 73-75

Securing Optimum Compaction of Highway Embankments

(Continued from page 18)

over, so it was necessary to operate at slow speed along the edges and sides of the fill. Speed was increased on the central portion of the fill. This difficulty was not encountered with the sheepsfoot roller, which could readily adapt itself to uneven and irregular surfaces.

In accordance with the specification requirements the three-wheel roller was operated in extreme low gear at approximately 3 feet per second. On one lift of section 2 the speed was increased to about 6 feet per second. The density determination showed that the compaction was undiminished at the higher speed and that an increase in roller capacity corresponding to the increase in speed could be obtained.

Relative Production in Indiana Project.—Table 4 shows that the pneumatic tire roller compacted a cubic yard of soil in 6-inch lifts in less time than the other rollers. The greatest number of trips of actual rolling was recorded for the three-wheel roller on section 2. The maximum production of 361 cubic yards per hour was obtained with the pneumatic tire roller on section 8 as compared with 244 for the three-wheel roller on section 2, and 341 and 255 for the sheepsfoot roller on sections 1 and 3, respectively.

With respect to the production of the sheepsfoot roller on sections 1 and 3, the greater production was obtained on section 1 even though the average number of trips required to obtain the specified density was 5% higher. The increase in production of 33% is attributed entirely to the increase of 38% in the roller speed.

On the sections where the material was placed in lifts having loose thicknesses of 9 and 12 inches, greater production was obtained with the three-wheel roller than with the pneumatic tire roller. The sheepsfoot roller was used only on the 6-inch lifts. A very definite increase in production was accomplished by increasing the lift thickness. The influence of lift thickness on the roller production is shown in figure 6.

Ohio Project.—On the sections where soil was placed in 6-inch lifts 12.9 seconds was required to compact a cubic yard of soil with the sheepsfoot roller on section 4 and 19.9 seconds on section 1. These figures compare with 16.4 seconds for the pneumatic tire roller on section 3 and 19.9 seconds for the three-wheel roller on section 2. The least amount of time necessary to compact 1 cubic yard on the sections constructed in 9-inch lifts was 13 seconds with the pneumatic tire roller.

Maximum production of 279 cubic yards compacted per hour was obtained with the sheepsfoot roller on section 4. On section 1, however, the sheepsfoot roller was able to compact only 181 cubic yards per hour. The greater production on section 4 indicates that the higher moisture content of the soil was significant in facilitating compaction. The average variation from the optimum moisture content on section 4 was —1 as compared with —2 on section 1. The percentages of the total number of lifts compacted at moisture contents below the optimum on sections 1 and 4 were, respectively, 94 and 74%.

The average number of cubic yards compacted per hour for the different rollers are summarized as follows:

Sheepsfoot roller:	
6-inch lift	245 cu. yd.
9-inch lift	255 cu. yd.
All sections	247 cu. yd.
Pneumatic tire roller:	
6-inch lift	220 cu. yd.
9-inch lift	277 cu. yd.
All sections	227 cu. yd.
Three-wheel roller:	
6-inch lift	181 cu. yd.
9-inch lift	247 cu. yd.
All sections	216 cu. yd.

TABLE 4.—*Summary of time and production studies of rolling in Gibson County, Indiana*

Section No.	Type roller	Thickness loose material per lift In.	Average speed of roller Ft. per min.	Use of Available Working Time: Rolling [1] Hr.	Waiting for material Hr.	Other operations Hr.	Volume Compacted: Total for section Cu. yd.	per hour of rolling Cu. yd.	Rolling time per cubic yard compacted Sec.	Average roller trips to obtain required density
1	Sheepsfoot	6	256	32.97	41.98	97.05	11,250	341	10.55	7.8
2	3-wheel	6	160	25.28	35.78	9.94	6,150	244	14.80	2.0
3	Sheepsfoot	6	185	19.08	26.85	5.07	4,855	255	14.11	7.4
4	3-wheel	9	150	11.08	15.67	9.25	5,074	458	7.85	2.4
5	Pneumatic tire	9	175	12.40	13.60	10.00	5.432	438	8.21	3.9
6	3-wheel	12	144	8.73	17.17	9.10	4,974	570	6.33	2.0
7	Pneumatic tire	12	220	11.27	29.08	6.40	6,280	557	6.44	2.7
8	Pneumatic tire	6	250	18.60	52.27	23.48	6,720	361	9.97	2.9

[1] Actual number of hours rollers were used for compacting.

These data disclose maximum production with the sheepsfoot roller on the 6-inch lifts and with the pneumatic tire roller on the 9-inch lifts. Although the increase in production obtained with the sheepsfoot roller as a result of increasing the lift thickness is very small, the production of the pneumatic tire and three-wheel rollers was increased materially. The influence of lift thickness on roller production is shown in figure 7.

Variations in production and compaction corresponding to different operating speeds of the rollers, as summarized from the daily records of the production studies, are given in table 5. Although it was impossible to maintain a constant rate of speed under the various construction conditions, it is believed that the speeds indicated represent the average speed during the period of observation. The data show a wide variation in volume of fill compacted per hour for the different roller speeds. There is, however, a definite indication that greater fill production was obtained at the higher speeds without any sacrifice in the quality of the compaction.

Performance of Sheepsfoot Rollers Compared With That of Other Rollers

Ohio Project.—Of the 100 lifts on which the sheepsfoot rollers were used, 87 were compacted with type A roller and 13 with type B roller. The average densities obtained with each roller and the average number of trips required to obtain this density were as follows: Type A roller with 7.8 trips produced 98.7% of maximum dry density and type B roller with 6.8 trips produced 97.7%.

When you need special information—consult the classified READER'S SERVICE DEPT., pages 73-75

Large Scraper Placing Fill Material on Section 1

Type B roller was used only on eight lifts of section 4, and five lifts of section 6. The remaining lifts on these sections were compacted with type A roller. On section 4 both rollers were loaded to capacity and an attempt was made to obtain the specified 100% compaction.

On section 6, in addition to using both rollers with the drums full of water, roller type B was used with the drums about half full of water. While in this condition all lifts were compacted by six trips and the soil densities determined. The densities obtained were considered satisfactory.

To meet the requirements of the specifications relating to the ground pressure under each tamping foot of sheepsfoot roller type A, it was necessary to fill the drums with water. There was a tendency at times for the tamping feet to pick up the soil and tear material loose rather than compact it. This was overcome by drawing out part of the water and reducing the ground pressure under each foot from 209 to 164 pounds per square inch. The required compaction was readily obtained in this manner.

Sheepsfoot roller type B was used only on 6 of the 20 lifts in section 1. It was first tried with the drums full of water. Under this load the feet dug up the soil and satisfactory compaction could not be obtained. It was then used with the drums half filled with water and gave good results. The most efficient operation was obtained when the drums were empty. In this condition the ground pressure under each tamping foot was approximately equal to that of sheepsfoot roller type A partially filled with water.

The compaction produced by construction equipment other than rollers was investigated on lifts 5 and 6 of section 7. Density tests were made in the path of the bulldozer and tractors spreading the material deposited by trucks.

The normal movements of the 17-ton bulldozer in spreading the soil on lift 5 produced a density of 94.4% of the maximum wet density. Two passages of the 11-ton tractor increased the density to 97.5%. This compares with 101.1% obtained with three trips of the pneumatic tire roller.

On lift 6 the density obtained with the 17-ton bulldozer was 93.3% of the maximum wet density. In one location, two passages of the 11-ton tractor did not increase the density, while in another instance the density was increased to 96.2%. This difference may be accounted for by the fact that in the former case the lower 2 inches of the lift was loose and uncompacted.

Although heavy rains occurred during the construction of the test sections in Ohio, they did not cause softening of the compacted lifts. The surface of the fill became slick and a small amount of slush was formed under the action of traffic but there was no detrimental rutting. Only removal of the slushy material by blading was needed to accommodate traffic over the fills without any inconvenience.

TABLE 5.—*Effect of roller speed on production and compaction in Delaware County, Ohio*

Section Number	*Type roller*	*Roller speed Feet per minute*	*Compaction [1] Percent*	*Volume compacted per hour of rolling Cubic yards*	*Average roller trips to obtain compaction*
1....	Sheepsfoot	250	100.1	172	8
		300	96.8	238	8
		300	91.8	172	10
		300	103.0	172	12
2....	3-wheel	100	108.2	75	3
		150	104.6	232	3
		200	110.1	264	3
		200	105.1	138	4
		300	104.3	294	3
3....	Pneumatic tire....	200	98.7	166	2
		200	105.6	164	5
		300	92.5	250	3
		300	101.7	223	4
		300	105.8	262	5
		300	104.0	244	6
4....	Sheepsfoot	200	100.1	222	6
		200	106.4	158	7
		230	100.3	257	6
		240	102.2	332	6
		240	101.3	176	9
		250	100.7	300	6
		270	101.6	408	6
		300	100.8	441	5
		330	96.0	380	6
5....	3-wheel	200	106.7	191	2
		240	104.0	236	3
		250	99.7	244	2
		300	107.7	269	4
		300	109.3	174	5
		330	99.2	290	5
		340	102.9	274	5
		400	109.8	317	5
6....	Sheepsfoot	200	100.0	194	6
		360	95.9	285	6
7....	Pneumatic tire....	300	100.0	319	6
		300	101.2	306	7
		400	102.2	258	8

[1] Compaction in percentage of maximum dry density.

The contractor was able to continue grading operations within a few hours after it stopped raining. Unsatisfactory condition developed only on the lifts compacted with the sheepsfoot roller. The small depressions left by the feet of the roller held water and became quite soft, necessitating considerable drying before additional material could be placed. This condition was overcome by smoothing out the surface with the three-wheel or pneumatic tire roller just as the rain was commencing. The edges of the fills were equally well compacted by all the rollers insofar as resistance to erosion was concerned.

In Indiana, elevations of the top of the fill were taken every 10 to 15 days during construction and at longer intervals afterward until the pavement was laid, 8 months later. The maximum settlement during this

(Continued on page 42)

Compacting with Pneumatic Tire Roller.

Table 3—Class C Communities, With Populations of 5,000 to 10,000

State	No. of Places	I	H	A	C	T	S	M	F	D	N	K	R
New England													
Maine	2				2		2	2	2	2	1		
Vermont	2									2			
Massachusetts	5									5	3	4	
Rhode Island	1									1		1	
Connecticut	1			1	1		1	1	1			1	
Middle Atlantic													
New York	1									1	1		
Pennsylvania	5				2	2	2	1	2	5	1		
South Atlantic													
W. Virginia	1		1	1					1	1		1	
S. Carolina	1											1	
East North Central													
Indiana	6	4	2	2	2	1	2	1	4	6	2		1
Illinois	3									3			
East South Central													
Kentucky	1				1	1	1	1	1	1	2		
Tennessee	5				4	1	5	4	4	5	1	2	
Alabama	1				1		1	1	1	1			
West North Central													
Minnesota	4		2		2		2	2	2	2	1	4	1
Iowa	5			3	3	1	1	3	3	5	1		
Nebraska	2	2	2	2	2		2	2	2				2
Kansas	1									1			
West South Central													
Louisiana	4	1	2	2	2		2	1	2	4			
Texas	2						1	1	1	2			
Mountain													
Arizona	1			1	1				1	1			
Totals	54	7	9	12	23	6	22	20	27	48	13	14	4

Table 4—Class D Communities, With Populations of 10,000 to 25,000

State	No. of Places	I	H	A	C	T	S	M	F	D	N	K	R
New England													
Vermont	1									1			
Massachusetts	8		1	4	2		3		4	7	3	4	
Middle Atlantic													
Pennsylvania	3	1	1		2	1	2		2	3			
South Atlantic													
W. Virginia	2			1	2	1	2	2	2	2	2	1	
S. Carolina	2			1			1	1	1	1		2	
Georgia	1				1		2		1	1	1	1	
Florida	1	1	1	1	1		1		1	1			
East North Central													
Ohio	3		3	1	3	1	2	3	2	3	1	1	2
Illinois	2									2			
East South Central													
Alabama	2				2	1	3	2	2	2	1	1	—
Mississippi	1			1						1			
West North Central													
N. Dakota	1				1	1	1	1	1	1	1		
Minnesota	4	1		2	2	1	2	1	1	4	1	1	
Iowa	1			1	1	1	1	1	1	1	1		
Kansas	1									1			
West South Central													
Louisiana	5		4	3	4	1	5	3	4	5			
Texas	2			1		1	1	1	1	2			
Totals	40	3	10	16	21	9	26	15	23	38	11	11	2

Table 5—Class E Communities, With Populations of 25,000 to 50,000

State	No. of Places	I	H	A	C	T	S	M	F	D	N	K	R
New England													
Massachusetts	1			1	1		1	1	1	1	1	1	
Middle Atlantic													
Pennsylvania	2	1	1	1	2		2	2	2	2			
South Atlantic													
Georgia	1				1		1		1	1		1	
Florida	1			1	1	1	1	1	1	1	1		
East North Central													
Wisconsin	1			1	1	1	1	1	1	1	1		
Ohio	1		1		1	1	1	1	1	1	1		1
East South Central													
Alabama	1				1		1	1	1	1		1	
West South Central													
Oklahoma	1									1			
Arkansas	1				1	1	1		1	1	1		
Texas	1		1		1		1	1		1			
Mountain													
Colorado	2				1			1	2	1			
Pacific													
Washington	1									1	1	1	
Totals	14	1	3	4	11	4	10	9	11	13	6	4	1

Table 6—Class F Communities, With Populations of Over 50,000

State	No. of Places	I	H	A	C	T	S	M	F	D	N	K	R
New England													
Massachusetts	2									2	1		
Rhode Island	1			1	1	1	1	1	1	1		1	
Middle Atlantic													
Pennsylvania	1									1		1	
South Atlantic													
So. Carolina	1				1	1	1	1	1	1	1		
Georgia	3				3		2	3	3	3	3	2	
East North Central													
Michigan	1									1			
Ohio	2				2		2	2	2	1	2		1
Indiana	3				1	1	1	1	1	3	1		
East South Central													
Tennessee	1				1		1	1	1	1	1		
Alabama	1				1								
West North Central													
Minnesota	1		1		1		1	1				1	
Iowa	1									1			
West South Central													
Arkansas	1				1	1	1	1	1	1	1	1	
Louisiana	1									1			
Mountain													
Colorado	1									1			
Pacific													
California	1		1		1	1	1	1	1	1	1	1	1
Totals	22	—	2	1	13	5	11	12	11	19	11	7	2

When you need special information—consult the classified READER'S SERVICE DEPT., pages 73-75

A Study of Recent Water Treatment Plants

(Continued from page 13)

ing devices; recarbonation; activated carbon. The first two are the only ones used by more than 40% of the communities.

In the other five groups we find a general agreement. Next to disinfection and filtration come chemical coagulation and sedimentation, with mixing devices in most of such cases. Following this come ammoniation and chemical dosage for corrosion correction. Then follow aeration, activated carbon, with comparatively few using recarbonation. In these B to F plants, few use iron or manganese removal—33 plants out of 301—and only 56 of that total employ softening.

It would appear, therefore, that for all communities of over 1,000 population, even the smallest employ practically the same general procedures as the largest. (Differences in details of equipment will be considered later.) When we arrange the communities by geographical districts, however, we find much less uniformity. Thus it appears in Table 9 that disinfection does not lead in the W.N.C. district, where it is employed by only 56.6% of the communities, while filtration is employed by 61.1%. In six of the nine geographical districts disinfection is employed by more than 90% of the communities. Recarbonation, although used in all of the population groups, is used in only 2 of the 9 districts, in fact, in only 4 states, Ohio, Minnesota, Nebraska and California. In the 18 plants in the Mountain districts no use was made of activated carbon, ammoniation, softening, or chemicals for corrosion correction, although all of these were used in all the other districts.

(Concluded in the October issue)

Table 7—Percentage of Use of Each of the Treatment Features
By Population Groups

Group	No. of places	I	H	A	C	T	S	M	F	D	N	K	R
A—100-1,000	173	30.1	25.4	38.7	22.5	1.2	30.6	15.6	57.2	67.7	—	21.4	8.7
B—1,000-5,000	171	12.8	18.7	29.8	40.4	7.6	40.4	33.9	55.6	78.9	8.8	29.2	3.5
C—5,000-10,000	54	13.0	16.7	22.2	40.7	11.1	40.7	37.0	50.0	88.8	24.1	25.9	7.4
D—10,000-25,000	40	7.5	25.0	40.0	55.0	22.5	65.0	37.5	57.5	95.0	27.5	27.5	5.0
E—25,000-50,000	14	7.1	21.4	28.6	78.6	28.6	71.4	64.3	78.6	92.8	42.8	28.6	7.1
F—Over 50,000	22	—	9.1	4.5	59.1	22.7	50.0	54.5	50.0	86.4	50.0	31.8	9.1
Totals	474	17.9	21.0	32.2	37.1	8.2	40.2	29.6	55.9	78.1	11.6	26.0	6.3
By Geographical Groups													
New England	38	—	5.2	18.4	18.4	2.6	26.3	18.4	34.2	92.1	26.3	34.2	—
M. Atlantic	47	4.3	10.6	10.6	31.9	8.5	29.8	25.5	34.0	97.9	4.3	6.4	—
S. Atlantic	53	7.5	9.4	24.6	64.1	13.2	67.8	45.3	73.4	90.6	24.5	47.2	—
E. N. Central	112	38.4	33.9	41.1	31.2	7.1	41.9	28.6	59.0	67.0	5.4	14.3	18.7
E. S. Central	47	4.2	14.9	19.1	70.2	8.5	72.3	57.5	72.3	95.7	12.8	25.5	—
W. N. Central	113	27.4	28.3	46.9	22.1	8.0	23.9	17.7	61.1	56.6	9.7	44.2	7.1
W. S. Central	42	7.1	21.4	33.3	47.6	11.9	42.9	35.7	42.9	92.9	9.5	4.8	—
Mountain	18	—	—	22.2	33.3	—	16.6	11.1	44.4	77.7	—	—	—
Pacific	4	—	25.0	—	25.0	25.0	25.0	25.0	25.0	100.0	50.0	50.0	25.0

Table 8—Order of Popularity. By Population Groups

Group	No. of Places	I	H	A	C	T	S	M	F	D	N	K	R
A—100-1,000	173	5	6	3	7	11	4	9	2	1	—	8	10
B—1,000-5,000	171	9	8	6	3	11	4	5	2	1	10	7	12
C—5,000-10,000	54	10	9	8	3	11	4	5	2	1	7	6	12
D—10,000-25,000	40	11	9	5	4	10	2	6	3	1	7	8	12
E—25,000-50,000	14	11	10	8	3	9	4	5	2	1	6	7	12
F—Over 50,000	22	—	9	10	2	8	4	3	5	1	6	7	11
Total U. S.	474	9	8	5	4	11	3	6	2	1	10	7	12

Table 9—Order of Popularity. By Geographical Districts

Group	No. of Places	I	H	A	C	T	S	M	F	D	N	K	R
New England	38	—	9	6	7	10	5	8	2	1	4	3	—
Middle Atlantic	47	10	6	7	3	8	4	5	2	1	11	9	—
South Atlantic	53	11	10	7	4	9	3	6	2	1	8	5	—
E. N. Central	112	5	6	4	7	11	3	8	2	1	12	10	9
E. S. Central	47	11	8	7	4	10	3	5	2	1	9	6	—
W. N. Central	113	6	5	3	8	11	7	9	1	2	10	4	12
W. S. Central	42	10	7	6	2	8	3	5	4	1	9	11	—
Mountain	18	—	—	4	3	—	5	6	2	1	—	—	—
Pacific	4	—	*	—	*	*	*	*	*	1	2	3	*

*All of these were included in only 1 of the 4 plants.

A Town Prepared for X Day

(Continued from page 15)

lb. of lead, 1,387 lb. of jute, 1 lot of fittings and valves, estimated at $4,917.60. Pipe 6" and less in diameter to be cast iron; larger diameters either cast iron or steel, lined, coated and wrapped.

4. New insulators and some new conductor on 11,000 V. transmission line between hydro-electric plant and city.

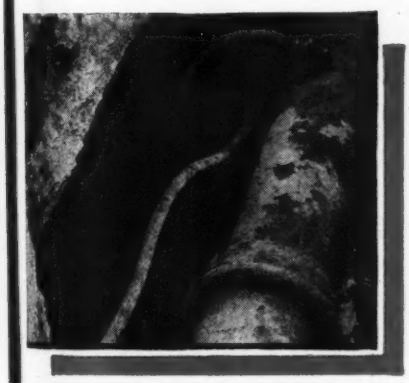
5. Grading, drainage and crushed gravel surfacing of 11,000 linear feet of 150-foot runway. Construction of apron and parking areas.

Modern equipment will be used in preference to hand work, in the belief that more and better work can be produced and that the dollar spent most efficiently ultimately creates the greatest number of man-hours of employment. The street department has all equipment necessary for road mixing and laying bituminous pavement, including two Galion motor patrols, Caterpillar tractor, a loader on Minneapolis-Moline tractor, Cedar Rapids crusher, three dump trucks and a Roscoe oil distributor. Equipment of the water and electric departments is ample for maintenance work but the larger projects for these departments will probably be let by contract.

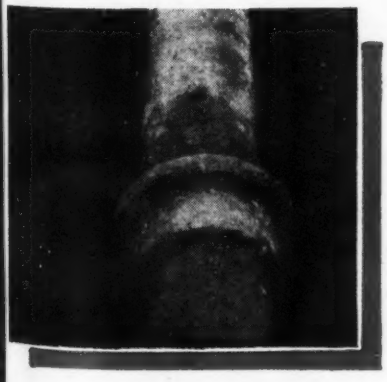
We realize that this program forms only a modest backlog in the long-range view of postwar employment. But we hope that we are blueprinting, in the words of E. L. Filby of the Committee on Water and Sewage Works Development, "a bridge of public works spanning the valley of unemployment between the end of the war and the beginning of full peace time industrial production."

her first municipal gas lamps were lighted-

Philadelphia laid a cast iron water main which is STILL IN SERVICE



Detroit, Michigan: Unretouched photograph of section of a 105-year-old cast iron water main.



Charleston, S. C.: Unretouched photograph of section of a 106-year-old cast iron gas main.

OIL LAMPS still lighted the sidewalks of New York and Philadelphia when America's oldest cast iron water main went into service in the year 1822. (Philadelphia was not lighted with gas until 1836.) Such bits of history help one to realize what radically changed conditions cast iron mains have lived through in more than a century of service.

The three cast iron mains shown in this advertisement, photographed while temporarily uncovered for inspection, are from 105 to 122 years old. These good and faithful public servants have paid for themselves many times over—have survived revolutionary changes in traffic conditions, building construction and public services—yet they are still rendering satisfactory service.

History is on the side of cast iron pipe—a history of long life, low maintenance, low cost per service year. But the brightest pages of its history lie ahead. For today's cast iron pipe is far different from the pipe of 100 years ago. It is made to scientific design, based on continuing field and foundry research, and with highly-developed production and laboratory controls at every step.

CAST IRON

CAST IRON PIPE RESEARCH ASSOCIATION

Thomas F. Wolfe, Research Engineer, Peoples Gas Building, Chicago 3

Serves for Centuries

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*All of these were included in only 1 of the 4 plants.

Compaction of Highway Embarkments

(Continued from page 34)

period was 0.09 feet and the average was 0.05 feet. There was an upward movement averaging 0.015 feet in section 1. In Ohio, where the concrete base and curb were constructed from 2 to 28 days after the completion of the embankment, the total settlement did not exceed 0.08 feet, and the curb in sections 1 and 6 started to move upward and did not afterward return. On six of the nine sections the average settlement was 0.025 feet, and on the other three there was an average upward movement of 0.017 feet.

Conclusions

The following conclusions seem justified in view of the fact that there have been neither indications of detrimental results from settlements nor indications of instability on any of the sections of either the Ohio or Indiana projects since the construction of the pavements.

Both Projects.—1. The compaction test may be utilized generally to control the construction of embankments regardless of the type of compacting equipment. It offers a practical means of determining when a layer of soil is satisfactorily compacted.

2. Data from compaction tests performed in the laboratory and from density tests made on the compacted fill offer a means of determining the moisture content and lift thickness at which satisfactory compaction may be obtained most economically with a given type of roller.

Indiana Project.—3. A density equal to 95% of the maximum as determined in the laboratory in accordance with method T 99-38 of the American Association of State Highway Officials is apparently sufficient to produce highway fills of satisfactory stability when the dimensions of the fills are similar to those on the project. The maximum height of fill in the various test sections ranged from 7 to 10 feet.

4. Soils similar to those comprising the fills on this project may be readily compacted to the desired density by any of the rollers used in this experiment if the moisture content of the soil is within the proper limits. With proper moisture content, equally good compaction was obtained throughout the entire thickness of a compacted layer regardless of whether the soil was compacted by the tamping action of the sheepsfoot roller, the kneading action of the pneumatic tire roller, or the compression produced by the three-wheel roller.

5. The moisture content of fills may be controlled within 1 of the optimum value when the soil is obtained from a borrow pit as was done on this project. Such rigid control, however, does not seem justified in light of the densities and stabilities obtained in this experiment with moisture contents ranging from 3.5 below to 7.9 above the optimum.

6. The high degree of stability attained at the wide range in moisture contents indicates that control of compaction on the basis of density alone will produce satisfactory results provided the soil contains sufficient moisture for the rollers to be effective and is not so wet as to interfere with the operation of the rollers. Definite limits above and below the optimum will depend entirely on the character of the soil. These limits may be determined by observing the performance of the rollers in conjunction with density tests.

7. The amount of fill material compacted per hour with a roller of a particular type depends on the type of soil, the moisture content of the soil, the thickness

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of the layer, and the speed of the roller. With soils and moisture contents typical of this project, it was found that when the loose thickness of the soil layer was increased from 6 to 12 inches and when the rollers were operated at their maximum speeds, a corresponding increase in roller capacity was obtained without any sacrifice in compaction.

Ohio Project.—8. Highway fills of satisfactory stability may be obtained when constructed in layers compacted to maximum density as determined on the same types of soils in accordance with the standard compaction test (Method T 99-38 of the American Association of State Highway Officials). Such embankments may be paved immediately following construction without danger of detrimental settlement.

9. Soils similar to those comprising the fills studied may be readily compacted to the desired density by any of the rollers used in this experiment when spread in layers having loose thicknesses of 6 to 9 inches. The soils ranged from silty clay loams to clays having physical properties of the A-4 to A-7 groups. They were of friable to hard consistency when dry but were plastic when wet.

10. A density equal to 95% of the maximum obtained in the compaction test is apparently satisfactory when the type of soils and the depth of the fills (5 to 11 feet over the old fill core and 7 to 21 feet on the widened portions) are similar to those on this project and when the moisture contents are reasonably close to the optimum.

11. Control of the percent of moisture within 1 of the optimum value is not practicable where the soil delivered to the fill is a mixture of materials varying in moisture-density characteristics. It is desirable that a greater permissible variation in moisture content from the optimum be established and this permissible variation should depend on the type of soil.

12. The use of moisture-density curves typical of the soils to be used and the selection of a particular curve in the manner described in this report facilitates the use of campaction test data under variable conditions, and is a practicable method of field control.

13. The construction of embankments may be controlled in accordance with the moisture contents and densities indicated by compaction test data without causing delay in construction operations.

14. The compaction of areas rolled at maximum roller speed is equal to that obtained at slower speeds. The higher speeds result in a corresponding increase in roller capacity.

Making Maintenance Earn Its Keep

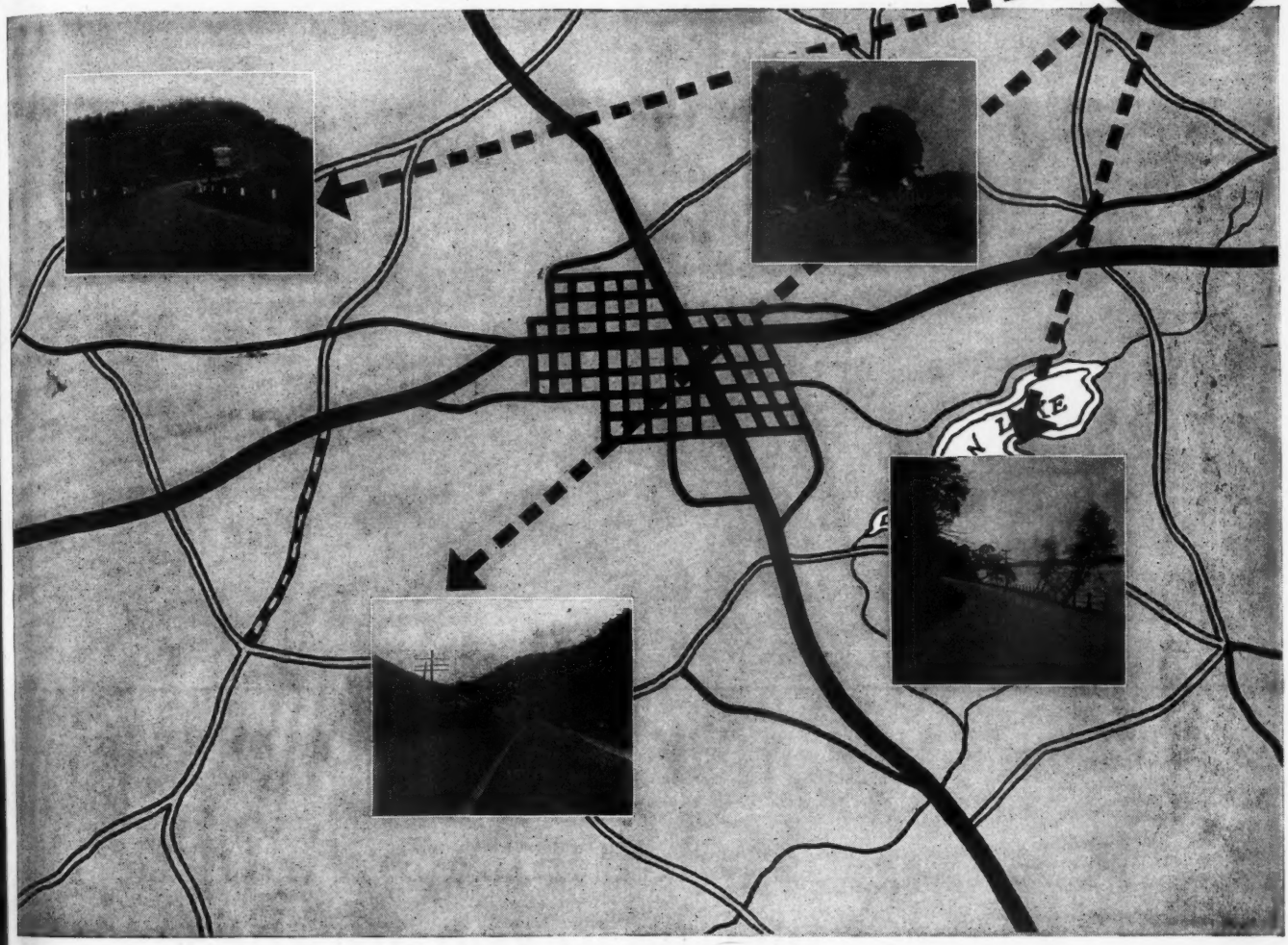
(Continued from page 30)

these consolidated surfaces are set up so hard and are so resistant to ravelling that they need only one-quarter as much attention. Because less blading is needed on the consolidated roads, quicker attention can be given to other roads in the county when maintenance is required.

Our use of calcium chloride is too recent to know exactly how much we are benefiting. We are learning each year better maintenance practices with the use of this material. We do know, however, that it is paying its keep. Our experience impresses us more than ever that maintenance should pay its keep as much as construction. Engineers inspect carefully their newly constructed roads and try to determine whether the

POSTWAR HIGHWAY PLANNING

It should start at these vital spots



THE U. S. Highway industry is already preparing for its greatest job after the war is won, for today's roads are wearing out faster than ever before and much-needed highway improvements have been unavoidably delayed by manpower and equipment shortages.

Especially in the all-important secondary road system, where regular maintenance is a first requirement, worn out roads are costing this country millions of dollars—in excess damage to automobiles and tires, delaying vital shipments of food and munitions, driving thousands of trucks prematurely to junk piles and seriously impeding transportation.

Why wait to make *your* plans for postwar highway work? Call on the services of the Tarvia field man. We can show you how to plan and prepare needed construction, reconstruction, maintenance and repair using local materials and local labor; how to clear the decks for postwar action.

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construction is delivering what was expected. I believe this same close scrutiny should be given to maintenance operations.

We have proven to our own satisfaction that highway maintenance need not be merely sustaining, but that it can provide betterment. We look to eventual improvement of all our limestone roads by consolidating them with calcium chloride and thereby conserving limestone and lessening patrol operations.

Rodent Control at Fort Devens

(Continued from page 28)

bait were taken by men, each of whom was assigned to a definite number of stations, and a little over one-half pound bait was added to each bait box and the cover of the bait box nailed down. This precaution was taken so that, in case any bait box should be knocked over the bait would not fall out through the opening in the top of the box. Where there was danger of the bait boxes being picked up around barracks, the box was nailed to the base of the building. After the pails had been emptied of poisoned bait, they were thoroughly washed.

On the night of the poisoning, the weather was damp and there was some doubt as to whether the rats would be out feeding in the same numbers as on a clear, warm night. At nine o'clock that evening a visit was made to the dump to determine whether or not the rats were feeding at the bait stations. It was found that they were and flashlight photographs were taken showing rats entering and leaving the bait boxes.

TABLE 1

Weights, Measurements, and Amount of Bait in Stomachs of Poisoned Rats

Sex	*Body and Tail*	*Weight*	*Bait Eaten*
M	20½ + 19½ cm.	440 grams	28 grams
M	19½ + 18½	375	32.5
F	19½ + 17½	307	27
M	20½ + 18	323	17
F	19½ + 18	322	15.5
M	21½ + 21½	552	31
F	19½ + 17½	287	19
F	20½ + 18½	391	30
M	20½ + 19	403	27
M	22½ + 21	569	42
F	19½ + 17½	328	19
M	20 + 17½	356	29
F	20½ + 17½	435	32
F	21 + 17	491	22
	Ave. total length 38.7 cm.	Average weight 398 grams	Aver. amt. eaten 26.5 grams

On the following day examination of the boxes indicated that approximately 75 or 80 pounds of bait had been taken. Over 200 dead rats were found lying on the dump. Those stations that had been cleaned were filled that night with bait taken from those stations that had not been accepted at all, and boxes at the latter stations were collected and brought to the dump so that approximately 125 pounds of bait was placed in 200 stations at the dump.

On the day following the second night of poisoning, it was found that about 50 pounds of bait was accepted and another 100 dead rats were found on the dump. The rats were picked up and incinerated. There was no way of determining the number of dead rats on the dump because of accumulations of trash and cans

where the rats could hide before dying. Some rats were observed wandering around in a sick condition. Many were covered up by the day's dumping. It was believed that the majority had retreated to their burrows and died there.

On the third night a visit was made to the dump, and with the aid of a powerful light borrowed from the fire department it was estimated that approximately 60% of the rats had been killed. This was merely an observation, for the dump was still crawling with rats. Fourteen dead rats were sent to the laboratory of the First Service Command for autopsy to determine the condition of the stomach and the weight of the amount of food in the stomach, and also the weight and length of the rats. The average weight was 398 grams, average length 38.7 cm, and average stomach contents, 26.5 grams. The stomachs were well distended, indicating little digestion had taken place, and it was concluded that the poison had acted rapidly in those rats that had eaten voraciously.

In estimating the kill, the following procedure was used: 125 pounds of bait was eaten which is equivalent to 56,750 grams. If the average rat ate 26.5 grams, it can be concluded that 2,141 rats ate the poisoned bait. This is assuming that the average rat had eaten to satiation at the bait station. However, because rats are in the habit of nibbling and because rats were observed chasing others away from the bait before they had finished feeding, and because garbage was also available to them, it is assumed that a considerable number did not eat as much as 26½ grams. It was noted that when one rat would enter a bait station, another would enter behind and bite it on the tail and force it out on the other side or chase it away from the bait station.

From experiments carried on by the Division of Predator and Rodent Control, it was found that a lethal dose of zinc phosphide for rats is 25 milligrams per kilogram of weight. The average weight of the rats being 400 grams, the lethal dose for the average rat would be approximately 10 to 12 milligrams. Therefore, if a rat ate only a gram of poisoned bait (which is equivalent to a nibble), it would be a lethal dose. From the observations as noted above, it may be assumed that over 3,000 adult rats were killed.

The rat being a most prolific breeder, having the capacity to breed a litter in 21 days and have 8 to 12 litters a year, it may also be assumed that a considerable number of nursing young were in the burrows. The adult female rats would return to the burrow and by nursing the young, would kill them also because it has been shown by experiment that the poison will be transmitted in the milk of the nursing mother to the young rats. There is, of course, no way of estimating how many young rats were destroyed.

The problem of eradicating 2,000 more rats still remained. Due to the expense of horsemeat and the fact that it is now a food used for human consumption, it was decided to try a poultry mash. Test-baiting with dry mash was tried for three nights, but this was not accepted, and the dry mash was then mixed with kitchen fat and while this was accepted a little better, it still would not warrant the use of poisoning. It was therefore decided to pre-bait again with the horsemeat. Three hundred pounds of horsemeat was ordered and pre-baiting was carried on for four nights, and poisoning done on the fifth night with thallium sulphate. Thallium sulphate is a very heavy, whitish gray powder having a specific gravity of 6.77. It is tasteless and odorless and insoluble in water. It does not dete-

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riorate with age and is a powerful and cumulative poison. It is rapidly absorbed through the skin and is extremely toxic to humans. It will kill rats in about 72 hours. It must be used only with the utmost caution. Even the vapors of boiling solution of thallium sulphate are toxic.

On the night of poisoning, a 2% mixture was used or approximately 3½ pounds of thallium sulphate to 175 pounds of horsemeat. The mixing was done in the same way as with zinc phosphide. All precautions were observed, such as use of rubber gloves, mixing in the open, and use of gas masks. The poisoned bait was placed in about 200 bait stations at the dump that evening. The following day only 15 dead rats were found at the dump. On the day following that, 40 more were found. On the third night an examination was made at the dump and only 12 live rats were counted. The same light was obtained from the fire department as before for this use. An examination was made two nights later and 50 live rats were counted. Therefore, it was estimated that there was probably an additional 300 rats left. The kill with thallium sulphate is much slower than with zinc phosphide. Where zinc phosphide will kill in 4 to 6 hours, thallium sulphate will take 24 to 72 hours, depending upon the quantity eaten. Approximately 75 pounds of the 175 pounds of poisoned bait set out was accepted. Estimating as previously with the zinc phosphide that 26.5 grams was the average amount of bait accepted, this would be equivalent to a kill of 1,330 rats. The lethal dose is 25 milligrams per kilogram, so it may be estimated that approximately 2,000 rats were killed with thallium sulphate.

Because of the fact that an estimated 300 rats remained, it was decided to use gas. The number of burrows at the dump cannot be estimated. Two hundred and fifty could be counted easily and there were a great number that could not be seen in the face of the dump and at the bottom of the dump covered with trash and tin cans, oil drums, logs, etc. Gassing was tried with hydrocyanic acid gas generated from calcium cyanide, which, using two dust guns, was pumped into the burrows where it would be hydrolyzed and release the cyanide gas. There was no way of telling how many rats were killed by this method.

Some of the burrows were dug out and three to four dead rats were found in each, but these had been poisoned previously. It was found that the burrows were interlacing and some extended distances of 15 to 20 feet. When gas was introduced in one burrow, the rat ran out another opening. To effectively block up each burrow would be a tremendous job.

Due to the impracticability of using gas, it was decided to use another dose of zinc phosphide. Approximately 12 ounces of zinc phosphide was mixed with 4 pounds of lard, and this mixture was spread on the slices of 25 loaves of bread. The slices of bread were tossed onto the dump and the following day 38 dead rats were picked up on the dump. The actual amount of bread eaten could not be determined due to the haphazard way it was thrown onto the dump and the fact that the bread was covered with trash newly brought to the dump so that no estimate could be made of the number of rats destroyed in this manner. Further night observations indicated that the rat population had declined to a point that a rat problem no longer existed at Fort Devens.

To prevent the re-establishment of a rat infestation, the dump is being covered over and is to be abandoned.

Pause one brief moment. Compare your lot—and that of the men and women in your employ—with the lot of the infantrymen who meet the enemy face to face, who do the hardest fighting, who suffer the most casualties.

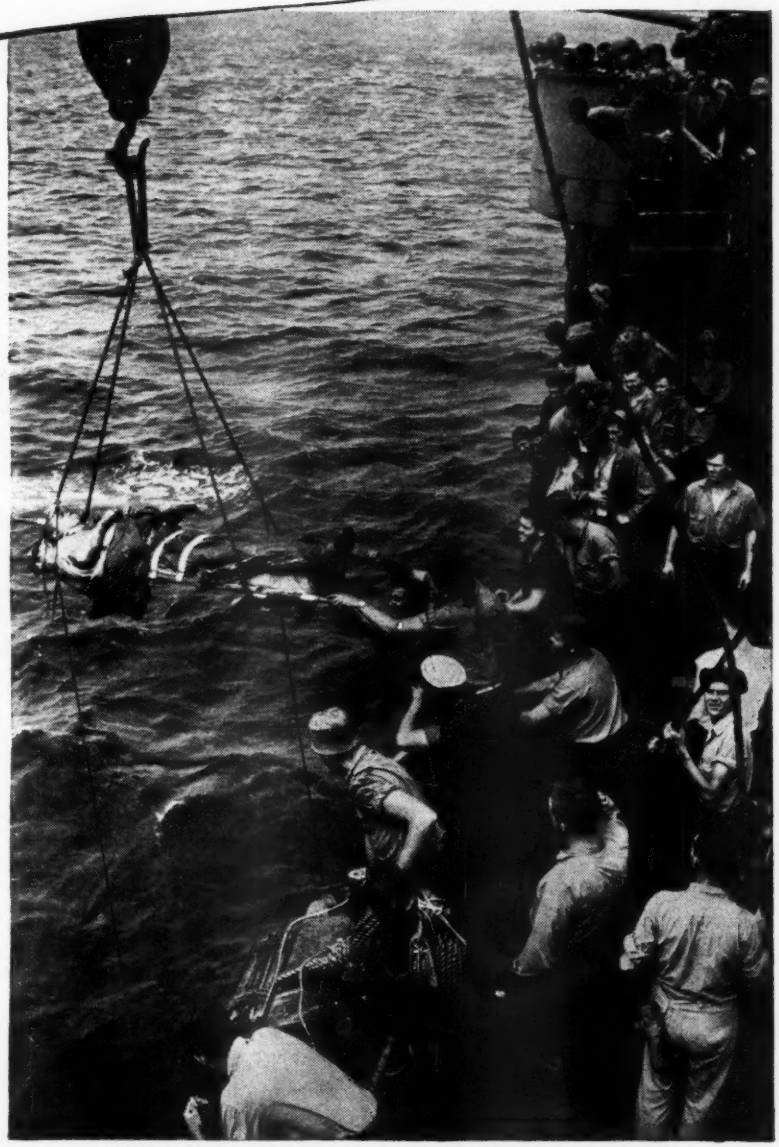
Let the full impact of war's unending grimness swiftly convert any tendency toward complacency into revitalized urgency. Remember—the war is not yet won.

As top management and labor, you've been entrusted with two major responsibilities—steadily maintained production, and steadily maintained War Bond Sales *through your Pay Roll Savings Plan.*

Decide *now* to revitalize your plant's Pay Roll Plan. Have your Bond Committee recheck all employee lists for percentages of participation and individual deductions. Have Team Captains personally contact each old *and new* employee. Raise all percentage figures wherever possible.

Don't underestimate the importance of this task. This marginal group represents *a potential sales increase of 25% to 30% on all Pay Roll Plans!*

Your success will be twofold: A new high in War Bond Sales; and a new high in production. Because a worker with a systematic savings plan has his mind on his work—not on post-war financial worries. He's taking care of the future now. His own. And his Country's future. *Help him!* REVITALIZE YOUR WAR BOND PAY ROLL SAVINGS PLAN.



Official U. S. Coast Guard Photo: The elevator to a Coast Guard-operated transport hospital

Back the Attack!

SELL MORE THAN BEFORE!

The Treasury Department acknowledges with appreciation the publication of this message by

PUBLIC WORKS Magazine

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The sanitary fill method of dumping is to be instituted to take its place.

Conclusions

1. A rodent control program should start with a complete survey to determine the extent of infestation and the amount of physical damage done. Observations should be made at night when the rats are out seeking food.

2. Infested buildings and areas should be located on a map and numbered accordingly.

3. Personnel to assist in the programs should be conscientious and interested in the programs.

4. Test-baiting should be done to determine what foods are most acceptable. Pre-baiting should be carried on until the maximum amount of food is being taken. Poisoning should be done when the maximum is reached.

5. All sources of food should be removed at the time the program begins. This will force the rats to eat at the bait stations and give as nearly a 100% kill as possible when the bait is poisoned.

6. Zinc phosphide and thallium sulphate are good poisons. The zinc phosphide is quick-acting and less expensive than thallium sulphate. The latter is tasteless and odorless. It may be used often without detection by the rats.

7. Notice should be given to the public as to when the bait is to be poisoned with the suggestion that domestic animals be restrained.

8. All rats and uneaten poisoned bait should be incinerated.

9. Where a small infestation exists and where burrows are in tight soil, gassing with calcium cyanide may be effective.

Note

The following officers and enlisted men assisted in carrying on the rodent control program at Fort Devens: Lt. Harold Udell, SnC.; Lt. Arthur Williamson, SnC.; Sgt. Joseph Bavis; Pvt. Earl Mineau (formerly with the Division of Rodent and Predator Control); Pvt. Arnold Blake; Pvt. William McGuire, Post Photographer; Sanitary Technicians of the 766th, 767th, and 769th Medical Sanitary Companies; Edward C. Hutchinson, U. S. Dept. of Interior, Fish and Wildlife Service.

Acknowledgment is made for editing the material to Lt. Col. Robert N. Clark, Sn.C., Assistant Chief, Preventive Medicine Branch, Headquarters First Service Command.

Iraq's Novel "Sink Bridge"

A novel movable-span bridge has been devised to provide for the passage of river traffic on the Shatt-al-Arab near Basra, Iraq, reports the foreign press. The bridge submerges 20 feet, instead of swinging or lifting to admit river traffic, leaving a 90-foot channel.

The span is 92 feet, it has a deck width of 15 feet, and weighs 35 tons. Road and rail traffic pass over the span as the weight normally is taken by two transverse bearing girders at each end. For river traffic, the weight of the span is lifted off the bearing girders by four hoists, one at each corner, from which cables operate over pulleys on overhead steel towers of gantry-like design. The bearing girders can be slid back by hand and the span can then be lowered.

To permit the lowering of the span, the parts of the piers between the hoist towers are recessed and these recesses are spanned by the bearing girders when in position. When the river traffic has passed, the hoists lift the span above the level of the bearing girders, which are slid out across the recesses, and again the span is put in place for resumption of rail and road services.

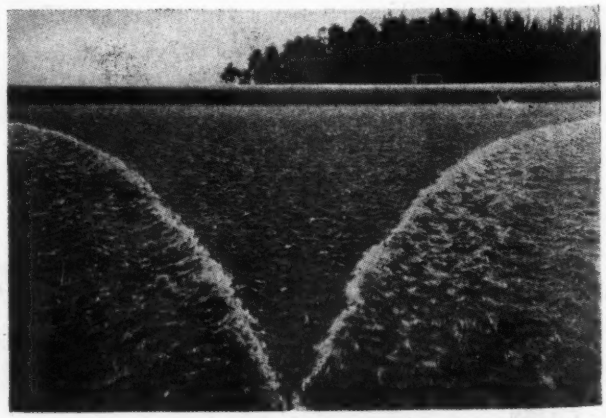
The bridge is said to be simple in design and operation, the piers are of timber pile construction, and the hoists are operated by hand. From *Foreign Commerce Weekly*.

Damage From Break in Water Main Denied

Recovery for damage resulting from a break in a city's water main was denied where the evidence showed that the broken main was installed in 1932, that it was laid below the frost line, and while open to inspection was subjected to the pressure under which it was to be used. The main was shown to have been properly laid in a properly prepared ditch. It was not subjected to any abnormal pressure nor to any exceptional internal or external force which would cause the break. It was held doubtful under the facts shown that a break occurring in 1941, after the main had been in the ground nine years, was due to a defect in the pipe which could with reasonable care have been discovered when the pipe was laid. The doctrine of res ipsa loquitur was held not to apply. To hold that a proper and reasonable use of water mains in cities "necessarily involves a risk of serious harm to the person, land or chattels of others" would, it was held, be contrary to the experience of at least several generations. (Midwest Oil Co. v. City of Aberdeen, South Dakota Supreme Court, 30 N. W. 2d 701.)

How Many Drops Make a Gallon?

Some years ago the Pittsburgh Equitable Meter Co. studied the drop-by-drop leakage from about a dozen faucets and found some facts that were communicated to the *Journal* of the A.W.W.A. Briefly, these seemed to show that the size of drops increased slightly with the rate of dropping. There was also a difference with varying sizes of faucets, but this was generally within 5% of the average. The averages given were: 10 drops per minute amounted to 15 gals. per month; 50 drops = 78 gal.; 100 drops = 163 gal.; 150 drops = 260 gal., and 200 drops = 367 gal. per month. This indicates that the drops at the highest rate are 22% larger than those at 10 per minute.



Little Rock's "V" for Victory. Formed as the water from Lake Winona flows over the spillway.

Strictly ~~on~~ off the Level!

Our Army Tanks are built for the high seas of dry land . . . up, over and down . . . up, over and down. The equipment that goes into those tanks must be able to operate perfectly no matter how rough the going.

Homelite gasoline-engine-driven Generators are used in M3 and M4 tanks for supplying electricity for radio, for gun turret operation and for battery charging. And no matter whether the tank is sticking its nose up in the air or taking a dive into a hole . . . *regardless of the angle* . . . the Homelite runs without trouble.

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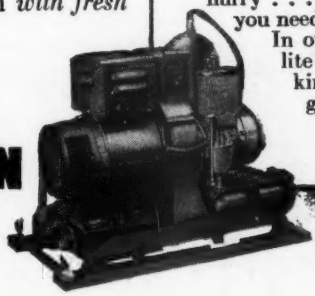

HOMELITE CORPORATION

PORT CHESTER, NEW YORK

Entrance gate to Princeton, N. J. sewage treatment plant.

The Sewerage Digest

Abstracts of the main features of all important articles dealing with sewerage and sewage treatment that appeared in the previous month's periodicals.

Land Disposal Of Sewage

Over 100 plants serving more than 400,000 population use some form of land disposal, 43 using treated effluent for the irrigation of crops. As a method of emergency disposal made necessary by destruction or breakdown of a treatment plant or its equipment, land disposal offers a simple, prompt and practical answer in many cases. In land disposal, agricultural operation may be of either primary or secondary aim, but in either case sewage should not be applied to the land raw; preliminary treatment should be at least fine screening and preferably 1 or 2 hours of sedimentation. Odor control is essential; oxidizing organisms in the soil must not be killed by continuous application.

In agricultural operation, best results are obtained by alternately treating different parts of the area, one year for disposal, the next year for farming. Not more than 2,000 or 3,000 gpd per acre should be applied and the climate should allow winter treatment.

If disposal is the primary aim, three methods are available: Intermittent application on prepared beds of relatively porous soil artificially drained; intermittent application on natural soil, drained; and oxidation in ponds where relatively little effluent percolates into the soil. The last the author calls "lagooning." This, as an oxidizing process, depends in part on the area of water surface available for aeration. He considers that there should be a minimum detention time of 20 days to eliminate pathogenic bacteria (5 days has been approved by the California State Dept. of Health); that there should be a minimum depth of 4 ft. to avoid vegetable growths on the lagoon bottoms (the State Board recommends a maximum of 3 ft.; W. T. Knowlton uses an average depth of 8 to 10 ft.). Mosquito breeding can be controlled by fish or by spraying once a week with a light oil that will evaporate rapidly and interfere for only a short period with oxygen absorption through the water surface. Preliminary sedimentation can, in an emergency, be accomplished in unlined ponds excavated in the ground, from which the sludge can be pumped out or removed with a clamshell bucket.

In Java, raw sewage has been found to contain 1 to 41 typhoid germs per cc, but none are found in effluents from lagoons. At Sonoma, Calif., sewage from 750 population is treated in 8 acres of lagoons 12″ to 18″ deep and the B.O.D. reduced from 150 to 2 ppm, B. Coli from over 100,000 to less than 100 per ml., and D.O. in the effluent ran from 4 to 14 ppm. In recent tests at lagoons at Calistoga, Calif., all were negative for D.O. before sunrise, but after that the D.O. increased to a maximum at 2 P. M., decreasing about sundown. There was a D.O. of the effluent of 9 to 17 ppm.[C77]

Collecting and Pumping Sludge

In sedimentation tanks, if the outlet piping is too small or contains short-radius bends, stoppages often occur; which can be avoided by frequent pumping. In one plant an automatic clock control regulates the pumping schedule.

Sludge is thixotropic (loses much of its plastic resistance on stirring); and the resistance decreases as the temperature rises—in one plant, pumping time is twice as long in winter as in summer. Therefore stirring and heating reduce the pumping load. For pumping sludge, a centrifugal is preferable when the percentage of solids is not over 3, a reciprocating pump for over that; also the former is generally preferable for secondary sludge, the reciprocating for primary sludge. Pumping sludge rather than using the hydrostatic head makes for more satisfactory plant results.

Sludge should be transferred from the sedimentation tanks to the digestion tank oftener than once a day; both tanks benefit from more frequent transfers. The time clock auto-control referred to secures one minute of sludge withdrawal every 20 minutes.[C71]

Disadvantages of infrequent removal of sludge are: (a) deterioration of the effluent, (b) scum formation in sedimentation tanks, (c) possible retardation of digestion. Sludge should be thoroughly removed from corners and side walls. Frequent sludge removal causes sludge of low solids concentration and greater volume in the digestion tank, cooling the tank and reducing its capacity. Slow removal from clarifiers lessens this. Thin sludge can be thickened in a special tank, but this slightly retards digestion. Uniform addition of raw solids makes for more successful results than intermittent large batches.[C75]

Controlling Sludge Digestion

Under normal conditions, the pH test, tank temperature and volume of gas produced are all the operator wants to know to find out if his digestion tank is operating satisfactorily. If the CO_2 content of the sludge gas exceeds 35 to 40%, trouble is due in a week or two. Total alkalinity should not be less than 1,000 ppm. In case of industrial wastes, it is advisable to control the process by means of the volatile acids. Acid conditions are usually rectified by use of lime, but ammonium sulfate is often used to control disturbances caused by industrial wastes, and in control of scum.

In withdrawing sludge from a digestion tank, sufficient seeding sludge should be left so that the daily addition of fresh solids should not exceed 2% by weight if the average tank temperature is 60°, or 4.5% if the temperature is 80°.[C72]

If the rate of liquefaction greatly exceeds that of gasification, because of either a depression of the activities of gasifying organisms or an acceleration of those of the liquefying organisms, the whole process of digestion is upset.

When supernatant liquor approaches 3,000-4,000 ppm of total solids, 1,000-2,000 ppm of B.O.D., and 2,000-3,000 ppm of volatile acids, returning it to the influent of the plant will have no appreciable effect on the subsequent treatment processes, even with activated sludge, especially if its return is spread over the entire day. Supernatant that is like thin sludge should not be returned

When you need special information—consult the classified READER'S SERVICE DEPT., pages 73-75

to the influent of the plant. The gelatinous nature of activated sludge is not readily destroyed by digestion, making it difficult for liquor to separate from the sludge.[C73]

Sludge Drying Beds

Odors from raw or partially digested sludge on drying beds can be minimized by use of hydrated lime or chloride of lime added to the wet sludge or sprinkled on the surface. At Aurora, Ill., the drying time was reduced 40% by using 1 lb. of alum to 93 gal. of sludge with solids content up to 8 or 9%. Sulfuric acid, ferric chloride and sulfate have given comparable results, but cost more. Alum-treated sludges are less affected by rain than those not so treated. At Tenafly, N. J., results using alum are erratic, but by using 4 to 5% ferric chloride the sludge could be removed from the bed on a fork after draining 10 to 20 hours, with 87 to 89% moisture.[C73]

Drainability of sludge increases with increased gas production, and optimum drainability of sludge coincides with the period shortly after the peak of gas formation. Storage of digested sludge decreases the drainability.[C75]

Sewage Sludge As Fertilizer

Sewage sludge contains enormous numbers of Azotobacters and Nitrobacters, which transform the nitrogen in the air to compounds which can be assimilated by plants for food, and break down humus, straw and other organic substances in the soil. Sludge prevents the leaching of nitrate salts from the soil. Chemical fertilizers are easily leached out by heavy rains. Sludge controls this leaching, as it holds many times its volume of moisture. It makes heavy coils porous and helps retain moisture in sandy soils. It contains growth-promoting substances, many of which are soluble and drain out of digesting sludge; Toledo found that drainage from sludge-drying beds was far more potent as a fertilizer than the dried sludge, and wonderful results have been obtained by applying liquid digested sludge directly to the soil.[C76]

Improving Tank And Filter Operation

The capacity of the Sioux Falls, S. D., treatment plant has been increased by several changes in details of the old plant. In the primary tanks the sewage crossed the full length of the tank and discharged over a weir at the outlet end. The change consisted of installing center feed and a peripheral weir and a circular scum baffle and grease skimmer, and filling in the corners of the square tank and removing the extension arms of the sludge collectors. These changes resulted in increasing the removal of B.O.D. from 40% to 55%, and of suspended solids from 60% to 75%.

The stone in the sprinkling filters was removed and washed and screened, thus removing fine material amounting to 28% of the stone. Rotary distributors were substituted for fixed nozzles, and the effluent was recirculated; this resulted in keeping the bed warmer last winter, and B.O.D. reductions varied from 60 to 90% of the applied load.[J13]

Grit in Buffalo Sewage

The sewage treatment works at Buffalo, N. Y., receives an average of 3.16 cu. ft. of grit per million gallons of sewage, of which about 60% is mineral and 40% organic solids. No grit accumulates in the new intercepting sewers, but many of the old flat-grade trunk sewers require continuous cleaning with dragline scrapers or flushing. Grit entering the sewage pump wet wells is swirled over the concrete floor by the sewage entering the pump suction and has eroded it to a depth of 8". This has been prevented by constructing on the floor four concrete vanes radiating from a point under the center of the pump suction, which

reduced the swirling action and not only prevented erosion of the concrete but also slightly improved the efficiency of the pump.

Large particles of grit at times wedged under the mechanical rakes of the fine screens, causing shearing pins to break. Fine grit caused rapid wear of shoes of the grit removal flights and the rails on which they ran. To facilitate future replacement of the rails, a 6" channel was set in the concrete, flanges up where the worn rails had been removed, and a 4" channel in this, flanges down; and strips of ⅜" spring steel were spot welded to the top of the latter channel to take the wear. Some of the sand, 70% of which passes a 60-mesh screen, finally reaches the digestion tanks, at times clogging the pipes bringing the sludge from the sedimentation tanks. In one case it was necessary to use a cleaning screw and water at 150 lb. pressure to remove the sand from these pipes, the material removed resembling paving asphalt. In the sludge incinerator the sand formed troublesome clinker.[H35]

Bibliography of Sewerage Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

C *Sewage Works Journal*
July

70. The Practical Side of Safety. By Warren D. Wilt. Pp. 687-695.
71. Sludge Collection and Pumping. By David W. Carmichael. Pp. 696-699.
72. Sludge Digestion: Operation and Control. By Albert B. Kozma. Pp. 700-704.
73. Sludge Dewatering. By J. K. Adams. Pp. 704-712.
74. Disposal of Sludge and Supernatant. By George H. Eckert. Pp. 712-715.
75. A Discussion of the Symposium on Sludge. By H. Heukelekian. Pp. 715-719.
76. Sewage Sludge as a Fertilizer. By A. H. Niles. Pp. 720-728, 843-844.
77. Emergency Land Disposal of Sewage. By Wm. J. O'Connell, Jr. and Harold F. Gray. Pp. 729-746.
78. Wartime Production of Aluminum Sulfate. By Richard W. Ockershausen. Pp. 747-750.
79. Wartime Production of Chlorine. By Ralph L. Carr. Pp. 750-753.
80. Wartime Production of Ferrisul. By Francis K. Burr. Pp. 753-754.
81. Wartime Production of Hydrated Lime. By Harry C. Bixler. Pp. 755-758.
82. Research Projects Under Investigation and Requiring Study. By Committee on Research. Pp. 759-773.
83. Effect of Cyanide Case Hardening, Copper and Zinc Plating Wastes on Activated Sludge Sewage Treatment. By G. M. Ridenour and John Greenbank. Pp. 774-788.
84. The Design, Operation and Maintenance of Sewage Lift Stations. By Douglas L. McLean and Arthur L. Puttee. Pp. 789-799.
85. A Unique Method of Gas Collection and Utilization. By J. P. Burden. Pp. 801-805.
86. Maintenance of Electrical Equipment in Sewage Treatment Plants. By L. F. Woolston. Pp. 805-809.
87. Centrifugal Pump Maintenance and Repair. By A. Nelson. Pp. 814-821.

D *The Surveyor*
July 21

20. Trade Effluent Policy. By John Hurley. Pp. 343-345.

July 28

21. Trade Effluent Policy. By John Hurley.

August 4

22. Trade Effluent Policy. By John Hurley. Pp. 370-371.

G *Water Works and Sewerage*
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25. Viscose Rayon Manufacturing Wastes and Their Treatment. By E. T. Roetman. Pp. 295-299.
26. Results of Effluent Chlorination at Cleveland. By John J. Wirts. P. 300.

H *Sewage Works Engineering*
August

35. Battling Grit at Buffalo Sewage Plant. By John W. Johnson. Pp. 386, 412.
36. Consumption and Production of Power at Sewage Works. Pp. 408-409.

J *American City*
August

13. Sioux Falls, S. D., Sets Its Sewage Plant in Order. By Kenneth V. Hill. Pp. 60-62.

M *Water and Sewage*
July

7. Sewage Treatment Plants in Canada. A Directory. Pp. 37-44.

P *Public Works*
August

36. Present Trends in Sewage Treatment. Pp. 11-15, 24.
37. New Additions to the Tucson Sewage Works. By R. M. Cushing. Pp. 20-24.
38. *n.* Disposal for Pail Latrines. P. 24.
39. Stream Pollution in St. Joseph River Basin. Pp. 51-52.
40. *n.* Service Charges for Sewerage and Garbage. P. 52.

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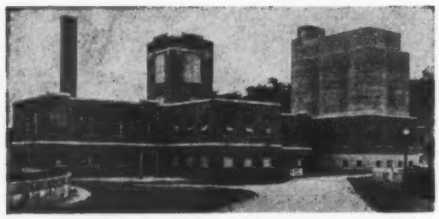


Chemical houses of the Kansas City, Mo., water softening plant; storage silos at the right.

The Waterworks Digest

Abstracts of the main features of all important articles dealing with waterworks and water purification that appeared in the previous month's periodicals.

Chlorine Ammonia and Bacterial Flora

In 1942 Amherst, Mass., substituted chlorine-ammonia treatment of its water supply for chlorination, which had been employed for about 18 yrs. This afforded an opportunity for the study of possible changes that might occur in the bacterial flora of the water in the distribution system. The supply is from reservoirs fed by brooks. At certain seasons of the year the water has a high organic content and there is no provision for sedimentation or filtration. The average consumption in 1942 was 629,286 gpd.

Summarizing the results of the study: Plate counts from water treated with chlorine-ammonia did not appear to be much influenced by the treatment. There was some increase in aerobic sporulating bacilli but no significance is indicated. About a year after the chlorine-ammonia treatment was instituted the numbers of positive presumptive tests began to increase substantially but were not confirmed on Endo's medium and positive refermentation tests were obtained from less than 10% of the positive gas tubes; probably most of the presumptive tests are false presumptives, for which the chlorine-ammonia treatment appears to be responsible. Further study is being made of this.[B14*]

Predicting Ground Water Yield

Experience in Meadville, Pa., since 1903 has proved that factors not mathematically predictable are far more important than permeability formulas in making a ground water inventory. Such formulas can be used to indicate the relative character of the formation under consideration and as one factor in the ground water inventory. In this district, in three instances, the safe yield of the formations has proved to be several times the quantity predicted by the arbitrary application of the permeability formula. In each case, had these predictions been followed, a great natural resource would remain undeveloped and lost to mankind.

To eliminate the unknowns from an equation which might be devised to predict yield, would require checkerboard test drilling of the entire drainage area, including the stream bed, at very short intervals, using methods of soil sampling and analysis superior to those now available. A far less expensive program would be the installation of permanent wells at favorable sites, followed by constant pumping to demonstrate and prove the practical rate at which water could be withdrawn for human use.

Since collection of data to form basis for accurate formula prediction of yield is impractical in regard to cost, estimates of safe yield will continue to be matters of judgment based on long experience in similar ground water problems, with careful consideration of all the complex factors which make up the ground water inventory.[F53]

Cost of Waterworks Structures

It is often necessary to make preliminary estimates of cost of structures, based on what similar structures have cost in the past. The accuracy of this is affected by both details of plan and construction and differences in cost of labor and materials; therefore such an estimate is likely to be very approximate. The author largely eliminates the latter by using the Engineering News-Record Construction Index to reduce all costs to those of September 1943. Costs of 31 concrete reservoirs so compared vary from $76,500 per m.g. capacity for a 0.125 m.g. reservoir to $18,000 for one of 21.54 m.g. capacity. Most of these reservoirs were of the box type—practically flat bottoms and vertical sides, covered with a concrete roof. The few circular reservoirs cost slightly less than rectangular ones.

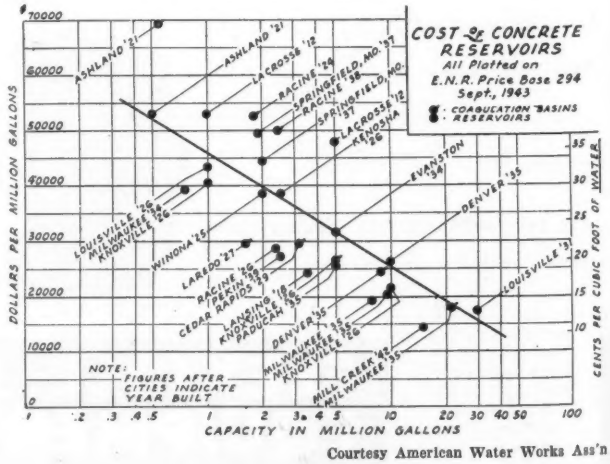
Pumping stations are compared on the basis of cubic footage, and the costs of 11 varied from $1.03 for a cubic footage of 4,990 to 28.6 cts for a cubic footage of 510,000. (One of 530,000 cost 50.5 cts.) Construction now or in the immediate future will probably be considerably more expensive because of the difficulty of obtaining labor and materials and other temporary conditions. "It is assumed that the time will come after the war is over when an ample reserve of skilled labor and material will be available, at which time building construction can be expected to resume its orderly course." But "In general, the costs of labor and materials have continued to increase, with ups and downs, for a century or more."[A100]

Survival and Retirement of Structures

In 1941 the A.W.W.A. appointed a Committee on Survival and Retirement Experience With Water Works Facilities, with which a committee of the N.E.W.W.A. has cooperated. This committee has collected data from 35 cities (those for 10 of them still incomplete), having 20,000 miles of mains, 30,000 valves, 1,000,000 meters, 900,000 services and 80,000 hydrants. A report covering studies in 25 cities, to be published as soon as possible, will contain some 250 pages and 65 mortality curves.[A101]

Legal Limits of Water Supply Systems

In the 1942 Public Health Service Drinking Water Standards appears the definition: "*Water supply system* includes the works and auxiliaries for collection, treatment and distribution from the source of supply to the free-flowing outlet of the ultimate consumer," thus including the plumbing in the houses. Based on this defi-



Courtesy American Water Works Ass'n

Costs of 29 reservoirs compared

*See Bibliography for August.

nition, the general public and consumers and courts and juries might presume that the officials of water works assume responsibility for detection and elimination of all potential health hazards on the premises of all consumers, including cross connections and other plumbing details. This responsibility can not be lived up to, even if accepted. Waterworks officials have no legal right to investigate piping inside private property lines except as they acquire it by the terms of a contract, stated or implied, or through the exercise of police power. But a regulation requiring (as an exercise of police power) a water supply agency to police the interior plumbing on the premises of all its consumers would be invalid because requiring an impossibility and because the responsibility already is imposed on the health authorities. Any item in plumbing fixtures, even in garden hose, not measuring up to modern standards would be considered a "sanitary defect" and might prevent the water from the system being certified by the Surgeon General as satisfactory for drinking water on interstate carriers. There is a moral responsibility on water works operators to use their influence to bring about better plumbing practices, but legal responsibility would be unjust and should not be admitted by operators.

Discussing the above, J. K. Hoskins, Asst. Surgeon General, said: "The Public Health Service does not agree that this definition places the legal responsibility for sanitary conditions beyond the meter solely on the water purveyor. . . . The water supply system was defined in the Drinking Water Standards so as to be all-inclusive in order to implement the necessary inspection and control by those having jurisdiction. A number of agencies may be involved: health authorities, municipal plumbing and building authorities and possibly others, in addition to the water purveyor. The proper authority should take up the problem where its jurisdiction controls and that of the other authorities ceases."[A104]

Cement Lining Mains in Place

In 1931 an 8″ main in West Palm Beach, Fla., which was badly corroded, was cleaned and the value of C increased from 62 to 133. By 1940 it had dropped to 81.2 and the pipe was cleaned and lined with cement by the Tate process. This increased C to 103.5 based on the nominal diameter. A 12″ main also was lined and its C increased from 61.0 to 99.5. A total of 5.8 miles was lined in 1940 and 5.5 miles in 1942. The cost of lining, including overheads and engineering, was 39.7% of the book cost of the mains involved, or 33% of the estimated cost of laying new cement-lined cast iron pipe, including replacing the pavement.

The author believes that the difference between the cost of lining in place and that of factory lining should be charged against the depreciation reserve, the cost of factory lining being charged to capital, as it represents increase in value.[G28]

De-ionizing Water Supplies

De-ionization of water may be defined as a process in which ions are partially or completely removed from an aqueous solution by ionic exchange or by acid adsorption. This definition does not include zeolite treatment or treatment with any cation exchange material operating in the sodium cycle, as this treatment does not reduce, but actually increases, the dissolved solids in the water to the extent of the chemical equivalents of the ions exchanged. These organic ion exchange materials are named "organolites", "organic ion exchangers", "electrolyte exchangers", etc.

There are two types of these materials—cation exchangers and anion adsorbers. The former are believed actually to exchange chemically ion for ion, whereas the anion exchanger acts as an adsorber attaching the acid radical to the exchanger material. Where softening alone is desired, the cation exchanger can be used in the sodium cycle to remove calcium and magnesium, the ex-

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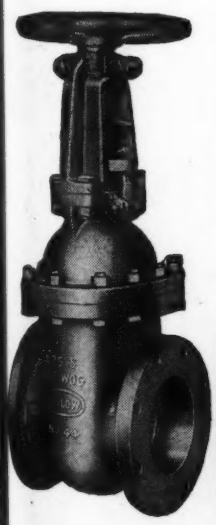

Ludlow List 44. Flanged, Double Disc Gate Valve with OS&Y. Iron body, bronze mounted. Cold working pressure, 200 lbs. Test pressure 350 lbs. Can be repaired in the field much easier than the wedge-type gate valve.

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changer being regenerated with salt as when zeolites are used. These exchangers are superior to zeolites in that usually they have a higher capacity, a greater pH range in the raw water, and they do not increase the silica content of the water.

De-ionization is particularly of interest to municipalities where excessive sodium bicarbonates are present in the raw water or where the chloride or sulfate content is intolerable. It is not a cheap method of treating water nor a substitute for present methods, but should be limited to special problems—reduction of chlorides, sulfates. magnesium and sodium bicarbonates.

An effluent from complete de-ionization is too good as well as too costly for a municipal supply; it is highly corrosive and chemical adjustment would be required, or treatment of only part of the supply and mixing this with the untreated part.[A105]

Bibliography of Waterworks Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

A *Journal, American Water Works Ass'n.*
August

98. Dollars and Sense of Depreciation. By Louis R. Howson. Pp. 803-810.
99. Municipal Depreciation Accounting Practices. By N. T. Veatch. Pp. 811-820.
100. A Review of the Cost of Water Works Structures. By Charles B. Burdick. Pp. 821-831.
101. Survival and Retirement Experience With Water Works Structures. A Committee Report. By E. J. Aldrich. Pp. 832-837.
102. Mobilizing the Utilities for War. By Edward Falck. Pp. 838-849.
103. Program and Policies of Water Division Office of War Utilities. By Arthur E. Gorman. Pp. 850-859.
104. The Legal Limits of a Water Supply System. By John H. Murdoch, Jr. Pp. 865-875.
105. The Economics of De-Ionized Water Supplies. By Frank Bachmann. Pp. 876-885.
106. Corrosion of Well Pumps. By T. E. Larson and J. B. Mills. Pp. 886-894.
107. The Calculation of Alkalinities and Free Carbon Dioxide in Water by the Use of Nomographs. By John F. Dye. Pp. 895-900.
108. The Effect of the Proposed New Jersey Ship Canal on Water Supplies. By Charles H. Capen. Pp. 901-907.
109. Renegotiation of Water Bills by Federal Agencies. Pp. 908-910.

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24. *p*. Surge Control in Pipe Lines. By C. F. Lapworth. Pp. 321-322.
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56. *p*. Unit Costs of Typical Waterworks Structures Tabulated. By Charles B. Burdick. Pp. 929-931.
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38. A Uniform Method of Recording Data on Water and Other Public Utilities. By Peter E. Brender. Pp. 30, 32, 34.
39. Laying a 24-Inch Water Main Under 26 Feet of Water. By F. G. Hocutt. P. 40.
40. Maintenance of Motors and Control Devices. Pp. 42, 44, 46, 48.

Placing Gravel Under a Bituminous Surface

By N. C. NICKERSON
County Highway Engineer, Carlton Co., Minnesota

FREQUENTLY, highway Engineers are faced with the problem of re-vamping surfaces that have been treated with bituminous mats which have failed for various reasons. One example of this condition was recently treated successfully and economically, without any waste of the original mat, by the highway forces of Carlton County, Minnesota.

The road in question was one which had been taken over from the township and made a county aid road. It had been surfaced with a thin mat of road oil, which did not stand up under traffic, and upon investigation it was found that the mat had been placed on a thin layer of gravel, averaging about two inches in thickness. The sub-grade was red clay, fairly uniform thruout but with some traces of silt. Naturally, this type of sub-grade would not support a thin mat of road oil under any but the lightest of traffic, and an increase in the thickness of the gravel surface was believed to be desirable.

The following method of increasing the gravel surface was adopted: First, the road oil mat was scarified and bladed into a windrow along one side of the road. Then from six to eight inches of selected gravel was spread onto the road and compacted by rolling. The windrow of blacktop was then pushed up onto the fresh gravel and over onto the other side of the road. New gravel was then spread where the windrow had been lying and this gravel was compacted. Then the windrow of blacktop was spread out over the entire road surface and rolled. Additional screened gravel was placed in a windrow along one side of the road, enough to make an additional mat of one and one half inches. This was then mixed with cut-back asphalt, (MC2 Minnesota Highway Department Specifications), spread and rolled. The finished surface has stood up excellently through one of the worst winters and springs in Minnesota history.

Damages for Failure to Carry Out Contract

In an action to recover damages for failure of the defendant to comply with a contract relating to the construction of an airbase, it appeared that, knowing of the plaintiff's intention and desire to place a bid on the airport project, the defendant promised to enter into a binding contract to do the specified work at a fixed price. This promise was never withdrawn and relying thereon the plaintiff submitted its bid to the government, as contemplated in the agreement between the parties. It was held that it would be unjust and unfair, after the plaintiff was declared the successful bidder and imposed with all the obligations of such, to allow the defendants to retract their promise and permit the effect of such restriction to fall upon the plaintiff. Other courts have been confronted with somewhat similar situations giving rise to the doctrine called "promissory estoppel." This doctrine is stated in section 90 of the Restatement of the Law of Contracts as: "A promise which the promisor should reasonably expect to induce action or forebearance of a definite and substantial character on the part of the promisee and which does induce such action or forbearance is binding if injustice can be avoided only by enforcement of the promise." (Northwestern Engineering Co. v. Ellerman, South Dakota Supreme Court, 10 N. W. 2d 879.)

"Danger—Traffic Jam Ahead"

By CHARLES M. UPHAM
Engineer-Director, American Road Builders' Association

A SHORT time ago in an Eastern seaboard state, two buses collided at a "Y" intersection where driving visibility is poor. Fortunately, no deaths resulted but a score were injured and two vitally-needed buses serving war workers were knocked out of commission.

That accident, as do so many, resulted from a combination of momentary letdown in carefulness and a highway condition bordering on the extremely dangerous. Drivers make highway accidents, but inadequate highways usually must take some if not most of the blame.

In Chicago there is one section of the Outer Drive which in many millions of miles of driving there was not a single fatal accident. But another section of street carrying equal traffic in the same period suffered several fatalities. The reason is clear. The section on which no deaths were recorded is a modern roadway, with traffic from opposite directions separated by a wide parkway, and grade separations at all intersections. Sideswiping and head-on collisions are impossible. On the other section, since modernized, traffic was not separated and there were no grade separations.

Recently 40 national groups, including the American Road Builders' Association, joined together with the National Safety Council in creating a postwar traffic safety program recently published under the title, "DANGER—Traffic Jam Ahead." That program, embracing education, enforcement and traffic engineering, is noteworthy in its emphasis on roads and streets themselves as accident factors. Every motorist, all citizens in fact, should read the concise statement on highway needs which follows:

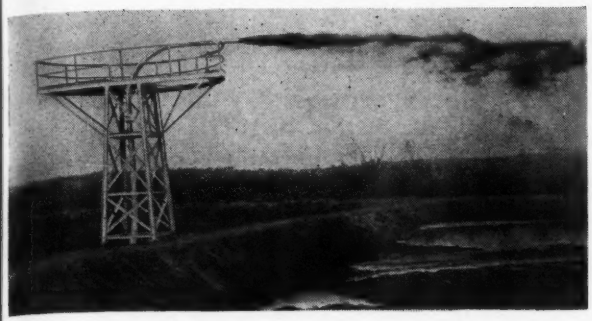
"Even prior to the war, our street and highway system was seriously inadequate. A vast mileage demanded construction or reconstruction. Improved facilities were needed in and around all major centers of population. During the war the highway construction program has been suspended except to provide essential access roads. Moreover, many streets and highways have not been maintained up to recognized standards because of shortages of labor and materials.

"It is reasonable to assume that money and manpower will be available at the end of the war for large scale highway construction. Such a program will present an unprecedented opportunity to build safety and efficiency into highways, both old and new. The recent report of the National Interregional Highway Committee, entitled 'Interregional Highways,' is an outstanding example of the sort of planning that is needed. But, if there is delay in authorizing preparation of detailed plans and specifications to implement this and other proposals, this tremendous opportunity may be lost. And, a hasty construction program to meet the threat of post-war unemployment may perpetuate past errors, sacrifice thousands of lives, and burden enforcement and educational agencies with unnecessary and complex tasks."

Clearly, only a combination of adequate roads and streets and careful driving will bring the accident toll down. In these war days every community should be getting its blueprints ready for post-war highway construction, and it should be getting its finances ready. Men will need jobs, and the increased traffic of tomorrow will need safer highway travel.

When you need special information—consult the classified READER'S SERVICE DEPT., pages 73-75

Keeping Up With New Equipment



Ejection tower for the "Transporter" at the St. Paul, Minn., Sewage Treatment Plant.

"Transporter," a Pneumatic Ejector for Conveying Bulky Materials

Yeomans Brothers Co.
1433 N. Dayton St., Chicago 22, Ill.

Operation of the "Transporter" is fully automatic. Material is delivered to the conical hopper which is set above the inlet valve body at the top of the machine. When incoming material has risen to a predetermined level in the receiver the program control begins operation. The loading device to the "Transporter" is stopped within a few seconds, an inlet flap valve is closed and held closed by the air piston. After full closure has been effected, the main air supply valve is opened, admitting compressed air.

Pressure of the air forces the contents of the receiver down toward the discharge. Once this action is started, an automatic air valve is closed and the air in the receiver is used expansively to complete the discharge and scavenge the discharge line. After the discharge line is blown clear, the pressure drops to atmosphere, the inlet flap valve is opened and the loading device resumes operation for another cycle.

The discharge from the tower shown in the picture above is of bulky material of such character and with low water content. It is continuously burned in the lagoons and requires no further handling. The "Transporter" is installed at the sewage treatment plant of the City of South St. Paul, Minn. It ejects 200 cubic feet at each discharge and has been in successful operation since 1940.

Pittsburgh-National Announces Full Domestic Line of Bronze Case, Empire Streeemline Meters

Pittsburgh Equitable Meter Company
400 North Lexington Avenue, Pittsburgh 8, Pa.

Coincident with the amendment to WPB order L-154 permitting the resumption of manufacture of domestic size water meters with bronze cases, The Pittsburgh Equitable Meter Company announced that their line of Empire Streeemline Meters had been expanded during the war interlude. The manufacturer states that sizes ⅝", ⅝x¾", ¾" and 1" are now available and that orders are being accepted for immediate delivery. With a full ¾" four-bolt meter and a six-bolt 1" meter, the popular Empire Streeemline Design is now made available for the complete range of domestic services. All sizes are said to embody the same general construction, including such features as a balanced oscillating piston operated within a two-part, snap-joint measuring chamber; an oil enclosed gear train assembled integral with the measuring chamber housing; and unit assembly of all

working parts without screws or bolts. Complete frost protection is claimed through use of a breakable cast-iron bottom plate which, upon release, permits all interior casting to separate to relieve parts from the strain and distortion normally caused by freezing.

Water meter buyers are invited to send for revised literature on the complete line of Empire Streeemline Meters. Write to Pittsburgh Equitable Meter Company, 400 North Lexington Avenue, Pittsburgh 8, Pa., and ask for Bulletin N-307.

Dyna-Stat Hydrostatic-Dynamic Pressure Test Pipe

Vulco Products Co.
409 West 36th St., New York 18, N. Y.

This device goes an important step further than previous methods of recording water pressure. Heretofore the common practice has been simply to connect a pressure gauge to any water supply outlet. When the hydrant or valve was opened and the gauge read, the results merely showed *static* pressure, not *dynamic* pressure.

Dynamic pressure means the measure of power in a water stream in motion and gives the true and complete picture as to how good or bad the available water supply actually is—or in what degree of effectiveness, this is definitely determined by the ratio of static to dynamic pressures.

The Dyna-Stat Test Pipe, a new product, is claimed to instantly and accurately record the dynamic pressure. With its help any ratio between static and dynamic pressures not within an acceptable range is immediately detected. The cause of the faulty flow may then be located and the trouble remedied.

As an example of the hazard involved in not checking dynamic pressure, take the case of a water supply outlet showing a static pressure of 150 lbs. but only 25 lbs. dynamic pressure. When 200 feet of fire hose were coupled to that outlet, even with a small nozzle tip, the cry would go up, "No water—no pressure!" A pumper attached to such an outlet would not help; it would merely pull a vacuum.

The Dyna-Stat Test Pipes are made in five sizes for testing hydrants and pumpers of various capacities. The illustrations show the approximately correct ratio between static and dynamic pressures on a test using 1⅛ inch outlet tip (.9940 sq. in.) at 120 lbs. static line pressure.

New Wellpoint Catalog

Moretrench Corporation
90 West St., New York 6, N. Y.

In the first section, over 90 types of construction are described. In part two some 30 items pertaining to the Moretrench Wellpoint System, pumps, etc., are described. In the two parts there are nearly 200 illustrations and line drawings.

The projects described are classified by types, making it easy to find a job similar to that in which you are interested—dewatering trenches for water and sewage mains, excavations for sewage treatment plants, pumping stations, etc.

Copies of this valuable Wellpoint Catalog will be sent upon reques

Caterpillar Lists All Its Products in a New 20-Page Booklet

"The Complete Line of 'Caterpillar' Products," a new 20-page booklet published by Caterpillar Tractor Co., Peoria, Illinois, illustrates the complete line of 'Caterpillar' Diesel Engines, Tractors, and Road Machinery or earth-moving. Described and pictured are the important jobs these machines are doing and will continue to do on the home front; moving earth, building and maintaining roads are included.

For a free copy of this interesting and informative booklet, ask for form D-41.

Heil Announces New Line of Twin Arm Hoists for All Trucks

Another development to come out of the war is the standardization of a line of new Twin Arm Hydraulic Hoists suitable for all makes of trucks and trailers and all styles of bodies by The Heil Co., Milwaukee. Formerly there was a vast assortment of styles and sizes of hoists for specialized purposes. The new Heil Hoists have been greatly simplified and save over 300 pounds of dead weight on an 1800 pound unit. They are completely fabricated and welded, require no heavy castings, eliminate many rollers, cams and gears, and permit operators to carry a greater payload on each trip.

Heil Twin Arm Hoists are capable of lifting loads of 24 tons to a 50° dumping angle in 10 to 15 seconds. The operation is smooth and noiseless and the body can be stopped and held at any angle without undue strain on the hoist mechanism. Loads may be dumped efficiently even when the truck chassis frame is twisted because of uneven ground.

Many years of exhaustive experimentation on test racks and in the field indicate that the life of the new Heil Twin Arm Hoist will extend substantially beyond that of the truck chassis upon which it is mounted.

The ability to standardize the new Heil Twin Arm Hoists on a few models for all purposes will eliminate the necessity for large dealer inventories, simplify mounting procedure, speed up deliveries and lower prices. The Heil Co., 3000 W. Montana St., Milwaukee 1, Wis.

General Excavator Company Announces "Machine of Tomorrow"

"A combination crane-excavator that, it is claimed, will revolutionize small construction, excavating and materials-handling jobs" is the description now being applied to a new "secret weapon" for post-war-minded contractors. Details on the new machine, developed by The General Excavator Company of Marion, Ohio, are being kept "under wraps" for the duration, according to Sales Manager Don B. Smith.

"Naturally we are proud," says Smith, "of the 'Machine of Tomorrow,' which we have designated the General Type 10. It will permit contractors to profitably handle a much broader range of miscellaneous jobs than was heretofore possible.

"Actually, the Type 10 is the result of 5 years of intensive development work on self-propelled excavating and materials-handling machines. As pioneer builders, before the war, of the highly successful one-man-operated, one-engined-controlled pneumatic-tired crane, our engineers already had a good start toward extending the versatility of this type rig to include excavating and construction work as well."

Balcrank Lubricator

Balcrank, Inc.
Cincinnati, Ohio

Balcrank engineers have designed the Model 166 for Tractor Lubricator trucks and road-maintenance equipment. Adequately and easily lubricates any equipment that requires grease to be forced through a fitting, such as ditch diggers, conveyors, etc.

High pressure volume delivery. 30 lb. capacity. Ruggedly constructed. Follow plate included to aid in handling heavy viscous greases. Lustrous red and black baked enamel finish. Long lasting oil resisting hose.

Easy up and down pumping—no gear or pinion to wear. Convenient to carry to and from jobs.

Balcrank Lubricator

Additions to the "Caterpillar" Line

The new program will make it possible to provide a complete "package" of machinery for earthmoving needs—bulldozers, scrapers, rippers and cable control units, the company says. They will be matched in design, materials and workmanship to the present "Caterpillar" products and be priced in keeping with the "Caterpillar" policy of building the best possible machines to be sold to the user at the lowest possible price. They will be sold and serviced through "Caterpillar" Distributors and Dealers, providing the customer with the advantage of a single channel of distribution, a single point of responsibility, and a single source of service and replacement parts.

A New Catalog on Galion Motor Graders—Diesel Power —Tandem Drive

This catalog covers the Galion Model 101 and Model 201 Tandem Drive Motor Graders . . . two versatile units of rugged design . . . fully capable of handling the variety of work now expected of the modern motor grader.

While this catalog features diesel power, gasoline power of comparable rating can be furnished if desired. Specifications covering gasoline power will be supplied upon request.

The Model 101 is powered by 68½ HP engine giving an operating weight of 20,800 lbs. to 23,000 lbs. depending upon equipment and accessories, adapting it to the heaviest kind of construction work.

The Model 201 is powered by a 50 HP engine with an operating weight of from 17,900 lbs. to 19,900 lbs., also depending upon auxiliary equipment. This grader is especially designed for heavy maintenance work, grading, scarifying, road-mix, snow removal and average construction work.

A well illustrated 28 page catalog describes in detail the many outstanding features of design, construction and operation which have made these graders unsurpassed in every field of motor grader service. Write The Galion Iron Works & Mfg. Co., Galion, Ohio, for Catalog 285.

Turbine Flow Rate Measurement

By W. K. Principle
Simplex Valve & Meter Co.
Philadelphia 42, Penna.

Operation of W-K Principle in combination with Simplex MO Meter clearly described and illustrated in a new bulletin Number 420. MO Meter

When you need special information—consult the classified READER'S SERVICE DEPT., pages 73-75

accurately indicates, records and totalizes flow rate measurement of Differential Taps in Water Turbine. Taps are placed on turbine installations already operating, as well as within new constructions. Design and engineering service offered by company.

Schroepfer Now Army Consultant

George J. Schroepfer, Chief Engineer and Superintendent of Minneapolis-St. Paul Sanitary District, has received authorization of the Board of Trustees and is now serving as a consultant to the Office of the Chief of Engineers of the War Department in Washington, D. C., in the preparation of a Technical Manual relative to preventive maintenance of equipment in Army Sewage Treatment Plants.

This is a part-time assignment, and he is continuing to serve this District in the capacity of Chief Engineer and Superintendent.

A. J. Kerr

M. D. Gilbert

C. K. Madison

W. S. Andrews

A. J. Kerr Appointed General Sales Manager for Pittsburgh Equitable Meter Co.

Colonel Willard F. Rockwell, President of the Pittsburgh Equitable Meter Company-Merco Nordstrom Valve Company, announces the appointment of A. J. Kerr to the position of General Sales Manager for the combined organizations. Mr. Kerr, a veteran of 20 years with the company, was District Manager of the firm's midwest headquarters at Tulsa, Oklahoma, prior to his Pittsburgh home office appointment.

Kerr brings to Pemco's head sales office a wealth of sales experience gleaned from his association with equipment buyers, engineers and operators throughout the country, as well as in his midwest territory. A member of The American Society of Mechanical Engineers, he was recently appointed to serve as manager of the society for a 3-year term..

A graduate of Carnegie Institute of Technology with a B.S. in Mechanical Engineering, Kerr was appointed District Manager of the Equitable Meter Company's Tulsa office in 1925.

Kerr's first act as Sales Manager was to appoint M. D. Gilbert as District Manager of the Tulsa office, C. K. Madison as District Manager of the Houston, Texas, office and W. S. Andrews as District Manager of the Pittsburgh, Pa., office of the company.

Yeomans Bros. Co. Appoints a New Representative

Engineering Equipment Company of Cincinnati now represents Yeomans Brothers Company in the Cincinnati area which has been enlarged to include Dearborn County in Indiana and the northern tier of Kentucky counties facing southwestern Ohio.

F. L. Holliday heads the firm which will represent the sales of all Yeomans products, including pumps, compressors and sewage treatment equipment. Holliday is an experienced pump man. He is a graduate of Georgia School of Technology with a B.S. degree in mechanical engineering.

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CONVENTIONS

Sept. 12-13. . . . The North Dakota Water and Sewage Works Conference will hold its 16th annual convention at the Strand-Pacific Hotel, Bismarck, N. D. The North Dakota League of Municipalities will hold its annual convention at the same time.

Sept. 19-22. . . . New England Water Works Association, Poland Spring House, Poland Spring, Maine.

Sept. 24-27. . . . American Public Works Association, Hotel St. Paul, St. Paul, Minn.

Oct. 1-4. . . . The Fifteenth Annual Meeting of the Institute of Traffic Engineers will be held at the Sherman Hotel, Chicago, Illinois.

Oct. 3-5. . . . Second Wartime Conference of the American Public Health Association, Hotel Pennsylvania, New York, N. Y.

Oct. 5-7. . . . Thirteenth Annual Meeting of Georgia Water and Sewage School, conducted jointly with R. & U. Branch of the 4th Army Service Command and Georgia Dept. of Public Health, will be held at Atlanta Municipal Auditorium.

Oct. 11-14. . . . Federation of Sewage Works Associations, William Penn Hotel, Pittsburgh, Pa.

Oct. 12-14. . . . Pennsylvania Sewage Works Association, William Penn Hotel, Pittsburgh, in conjunction with the Federation of Sewage Works Associations.

Oct. 17-19. . . . Southwest Section of American Water Works Association, Stephen M. Austin and Driskill Hotels, Austin, Texas.

Oct. 24-26. . . . California Section, American Water Works Association, Biltmore Hotel, Los Angeles.

Nov. 14-15. . . . South Dakota Water and Sewage Works Conference, Watertown, S. D. It was originally planned for Sept. 19-20.

Lloyd Reid

Lloyd Reid Joins International Salt Co.

Lloyd R. Reid, Traffic Engineer of Detroit, has joined International Salt Co., Inc., as a consulting engineer. Mr. Reid was formerly Michigan State Highway Commissioner and is well informed on all matters pertaining to highway management among both federal and state officials.

In his new post Mr. Reid will assist in an aggressive program to maintain highways free of snow and ice during the winter months by spreading augar action rock salt during storms. This melts the snow and ice, preventing it from bonding to the road surface, and aiding the task of highway and street departments in keeping roads open.

Phillips to Head Distribution of Surplus Construction Equipment

Ed. P. Phillips, well known Construction Equipment Engineer, has been appointed Director of the Construction Machinery and Farm Equipment Section of Treasury's Surplus Property Division. Mr. Ernest L. Olrich, Assistant to the Secretary, announced today. A native of Richmond, Va., Mr. Phillips is the senior partner of Phillips Machinery Company, with offices in Richmond, Va., and Washington, D. C. He was president of the Associated Equipment Distributors in 1943, and Vice President of the American Road Builders' Association.

Smallhorst Goes Overseas

Captain David F. Smallhorst, Sn. C., at his own request, has been assigned to overseas duty and is now in a staging area. Captain Smallhorst has been on duty in the Sanitary Engineering Division, Preventive Medicine Service, Office of The Surgeon General, since January, 1943. He has been in charge of procurement and assignment of sanitary engineers and entomologists for the Sanitary Corps, and also for the War Manpower Commission. During the period in which he handled Sanitary Corps personnel, 460 sanitary engineers and more than 120 entomologists were commissioned. In addition, Captain Smallhorst was in charge of the Insect and Rodent Control Branch of the Sanitary Engineering Division. Lt. Robert S. Taggart, Sn. C., formerly district engineer of the New York State Department of Health, has succeeded Captain Smallhorst.

The Asphalt Institute Establishes Portland, Oregon, Office

The Asphalt Institute
801 Second Avenue, New York 17, N. Y.

Bernard E. Gray, General Manager of The Asphalt Institute, announces that W. A. Bugge has been appointed District Engineer for the territory comprising northern California, Oregon, and western Washington, with offices at 301 Wilcox Building, Portland, Oregon, and 1304 Fourth Avenue, Seattle, Washington.

W. A. Bugge

Mr. Bugge's engineering experience, starting in 1922 in the Washington State Department of Highways, covers twenty-two years, including long service as County Road Engineer of Jefferson County and during the past four years as City Engineer of Port Townsend. He is a past president of the Washington State Association of County Engineers.

New Asphalt Construction and Research Pamphlets Issued

Asphalt Institute Reprints Illinois Conference Papers on Resurfacing and Design

The Asphalt Institute has issued two 16-page pamphlet reprints of papers presented at the First Illinois State Asphalt Conference, as follows:

CONSTRUCTION SERIES NO. 69—"Construction and Resurfacing of Primary Highways," by Bernard E. Gray, General Manager-Chief Engineer.

RESEARCH SERIES NO. 10

(Continued on page 76)

Readers' Service Department

These booklets are FREE but distribution is restricted to those actively engaged in engineering or construction. Use the coupon or write the manufacturer direct, mentioning PUBLIC WORKS.

Construction Materials and Equipment

Airport Radio Traffic Control

5. "Highways of the Air" is a new and valuable booklet available for engineers and officials interested in radio traffic control for airports. Illustrated and non-technical. Address: Radio Receptor Co., Inc., 251 West 19th Street, New York 11, N. Y.

Cold Mix Plants

15. New catalogs and prices of Portable Bituminous Mixers in 6 to 14 ft. sizes for resurfacing and maintenance. Issued by The Jaeger Machine Co., 400 Dublin Ave., Columbus 16, Ohio.

Cold or Wet Weather Construction

18. Cleaver Aggregate Heaters and Dryers, Hot Water Boosters, and Automatic Steam plants are designed to speed up cold or wet weather construction. Write for illustrated bulletins. Cleaver-Brooks Co., 3112 W. Center St., Milwaukee 9, Wis.

Concrete Accelerators

31. New 48-page booklet in five sections explains clearly the effects, advantages and methods of using Calcium Chloride and Portland Cement mixes. Complete and packed with practical information; well illustrated; pocket size. Sent free on request by Solvay Sales Corp., 40 Rector St., New York 6, N. Y.

Concrete Curing

33. 64-page manual of concrete curing with calcium chlorides. Complete, handy. Contains useful tables, well illustrated. Write the Columbia Chemical Division, Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh 19, Pa.

Concrete, Early Strength

38. 64-page manual tells how to speed up year 'round concreting, shows how to secure high early strength and greater workability at temperatures either below or above freezing. Contains many actual examples of practical concreting operations; well illustrated with more than 60 photos, charts, graphs and tables. Calcium Chloride Assn., Penobscot Building, Detroit 26, Mich.

Concrete Mixers

44. Catalog and prices of Concrete Mixers, both Tilting and Non-Tilt types, from 3½S to 56S sizes. The Jaeger Machine Company, 400 Dublin Ave., Columbus 16, Ohio.

Drainage Products

70. Standard corrugated pipe, perforated pipe and MULTI PLATE pipe and arches — for culverts, sewers, subdrains, cattlepasses and other uses are described in a 48-page catalog entitled "ARMCO Drainage Products," issued by the Armco Drainage Products Association, Middletown, Ohio, and its associated member companies. Ask for Catalog No. 12.

Generators

80. Two portable generators, one for AC and the other for DC current are described in new bulletin issued by Homelite Corp., Port Chester, N. Y. Commonly used for operating electrical equipment in planes, tanks and trucks, or to charge batteries or to supplement batteries for starting main engines, etc.

Finishing Machines

96. Flex-Plane Finishing Machines around the world. Handsome new folder shows various models in action. One machine combines screeding and longitudinal and transverse contracton joint installing. Available from Flexible Road Joint Machine Co., Warren, Ohio.

Graders, Patrol

98. The Austin-Western 99M Power Grader with its powerful all wheel drive simplifies all construction and maintenance; handles difficult jobs with economy and efficiency; and does better work on grading, ditching, scarifying, snow plowing, loading, mixing, bulldozing, shoulder, trenching and backsloping. Write for Bulletin 1946. Austin-Western Co., Aurora, Ill.

Joints, Expansion

103. Joint Data. Expansion and contraction ribbon joint installers. Flexplane units and finishers. Catalog illustrates how machine installs both longitudinal and tranverse joints rapidly. Flexible Road Joint Machine Co., Warren, Ohio.

Mixing Plants, Asphalt

106. The Cleaver Asphalt Mixing Plant for an inexpensive plant mix and the Cleaver Tank Car Heater and Bituminous Booster are covered in illustrated catalogs sent on request by Cleaver-Brooks Co., 3112 W. Center St., Milwaukee 9, Wis.

Mud-Jack Method

107. How the Mud Jack Method for raising concrete curb, gutter, walls and street solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities — a new bulletin by Koehring Company, 3026 West Concordia Ave., Milwaukee 10, Wis.

Paving Materials, Bituminous

111. New "Tarvia Manual" is packed with useful data on how to build and maintain roads with Tarvia. Each step is illustrated with excellent action pictures, 64 pp. 103 ills. Write to The Barrett Div., 40 Rector St., New York 6, N. Y.

Pumps

115. Interesting new booklet tells how to lengthen the life of your pumps. Explains how a little care will save a lot of wear. Write today for your copy. Homelite Corp., 2403 Riverdale Ave., Port Chester, N. Y.

116. New illustrated catalog and prices of Jaeger Sure Prime Pumps, 2" to 10" sizes, 7000 to 220,000 G.P.H. capacities, also Jetting, Caisson, Road Pumps, recently issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus 16, Ohio.

117. New brochure by Gorman-Rupp Co., Mansfield, Ohio, illustrates and describes many of the pumps in their complete line. Covers heavy duty and standard duty self-priming centrifugals, jetting pumps, well point pumps, triplex road pumps and the lightweight pumps.

118. 16-page illustrated bulletin, SP-37, describes and illustrates complete C. H. & E. line of self-priming centrifugal pumps from ½" to 8", including lightweight models for easy portability. C. H. & E. Mfg. Co., 3841 No. Palmer St., Milwaukee 12, Wis.

119. "Self-Priming Centrifugal Pumps," a 12-page illustrated booklet showing details of construction of Carter Pumps. Ask for Bulletin 4310. Address: Ralph B. Carter Co., Hackensack, N. J.

120. "Humdinger" 2- to 8-inch self-priming portable pumps. A 23-page illustrated booklet giving full details. Address: Ralph B. Carter Co., Hackensack, N. J.

Road Building and Maintenance

128. Two powerful Galion motor graders designed to answer every requirement for more speed in road, airport, dam and housing construction work are fully described in a folder illustrated with many action pictures. Issued by Galion Iron Works & Mfg. Co., Galion, Ohio.

129. Warco Hydraulic Control Motor Graders, Duplex Hydraulic Scoops and Whizzard, easily transported, rollers are described and illustrated in literature available from W. A. Riddell Corp., Bucyrus, Ohio.

130. BG Maintainer, a powerful, speedy, low-priced machine for light road maintenance. Write for folder. Huber Mfg. Co., Marion, Ohio.

131. Speed Scoop. A versatile small scraper unit, ideal for emergency repairs. Illustrated folder issued by Huber Mfg. Co., Marion, Ohio.

Rock Drill Maintenance

132. New booklet presents through amusing cartoons useful hints on proper rock drill maintenance methods—what your men can do to get more work out of your tools with a minimum of expense for repairs and compressed air. Write The Cleveland Rock Drill Co., 3734 East 78th St., Cleveland 5, Ohio.

Rollers

133. New Tu-Ton roller of simple construction for use in rolling sidewalks along highways, playgrounds and other types of light rolling is fully described in a bulletin issued by C. H. & E. Mfg. Co., 3841 No. Palmer St., Milwaukee 12, Wis.

138. "The Buffalo-Springfield line of road rollers (tandem, 3-wheel, and 3-axle) are described in the latest catalog issued by the Buffalo-Springfield Roller Co., Springfield, Ohio.

139. "Ironeroller" 3 Axle Roller for extra smooth surfaces on all bituminous work. Booklet contains roller data and operation details. The Hercules Roller Co., Bucyrus, Ohio.

140. This well-illustrated 16-page catalog describes the tandem, autocrat, cadet, and roll-a-plane rollers, and explains what each is intended to accomplish. Write Austin-Western Co., Aurora, Ill.

141. Three-Wheel Rollers. Huber Automative type rollers in 5 to 8 ton sizes and Huber 10 & 12 ton diesel rollers. New bulletins give full details and specifications. Huber Mfg. Co., Marion, Ohio.

142. Tandem Rollers. Variable weight tandem roller with three speeds forward and reverse for new highway surfacing and old road conditioning. Huber Mfg. Co., Marion, O.

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Soil Stabilization

150. "High-Service, Low Cost Roads" is one of the newer booklets using an effective combination of picture and text to set forth the principles and advantages of road surface stabilization with calcium chloride Complete, interesting and well illustrated 34 pages. Sent by Solvay Sales Corp., 40 Rector St., New York 6, N. Y.

152. The Columbia Chemical Division will be glad to furnish to anyone interested complete information dealing with Calcium Chloride Stabilized Roads. This literature contains many charts, tables and useful information and can be obtained by writing Columbia Chemical Div., Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh 19, Pa.

154. "Soil Stabilization with Tarvia"—An illustrated booklet describing The steps in the stabilization of roadway soil with Tarvia will be mailed on request by The Barrett Division, 40 Rector St., New York 6, N. Y.

Spreader

187. Jaeger Paving equipment, including Mix-In-Place Roadbuilders, Bituminous Pavers, Concrete Bituminous Finishers, Adjustable Spreaders, Forms, etc.—4 complete catalogs of latest equipment in one cover, issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus 16, Ohio.

Surface Consolidation and Maintenance

188. Detailed and illustrated presentation of the method and procedure in consolidated operations; explains how sub-soils can be conditioned to resis softening and frost action; how surfacing can be consolidated to provide smooth all-weather riding surfaces; how they can be maintained so as to prevent disintegration and gravel loss. Write the Calcium Chloride Association, Penobscot Bldg., Detroit 26, Mich., for Bulletin No. 29.

Transits and Levels

190. Transits, levels, and drafting room supplies: New Catalog just issued. 56 pages giving full illustrated descriptions of surveying instruments and accessories. Address: Warren-Knight, 136 N. 12th St., Philadelphia 7, Pa.

Wellpoints

195. New complete catalog, "Griffin Pointed Wellpoint Facts," just issued. Covers pre-drainage, describing wellpoints jetting pumps, with tables, diagrams and illustrations. Griffin Wellpoint Corp., 881 E. 141st St., New York 54, N. Y.

Street and Paving Maintenance

290. "Blacktop Road Maintenance and Construction Equipment" — Asphalt and tar kettles, flue type kettles, spray attachments with completely submerged pumps, tool heaters, surface heaters, road brooms, portable trail-o-rollers, etc. These are all described in detail and illustrated. This modern and up-to-date equipment for blacktop airport and road construction and maintenance is based upon experience and engineering research over a period of 42 years. Write for Catalog R. Littleford Bros., Inc., 452 East Pearl St., Cincinnati 2, O.

Fire Apparatus

300. Detailed information and advice about specially engineered Ward LaFrance apparatus will be sent on request. Ward LaFrance Div., Elmira, N. Y.

Snow Fighting

Snow Plows

350. "Frink One-Way Sno-Plows" is a four page catalog illustrating and describing 5 models of One-Way Blade Type Sno-Plows for motor trucks from 1½ up to 8 tons capacity. Interchangeable with V Sno-Plow. Features, specifications and method of attaching. Carl H. Frink, Mfr., Clayton, 1000 Islands, N. Y.

Ice Control

352. Fast, self-feeding spreaders for ice control and seal coating that replace end gate on any dump truck, operated by driver of truck, are illustrated in new bulletin issued by Flink Co., 506 Vermillion St., Streator, Ill.

353. The new Flink sand spreader attachment that spreads sand faster from thinnest surfacing up to 2" layers and keeps a perfect edge is described in bulletin sent promptly by Flink Co., 506 Vermillion St., Streator, Ill.

Sanitary Engineering

Aero-Filter

356. Aero-Filter Design Data is given in a new 32-page catalogue. It contains information on Advantages of Aero-Filter Process, Single Stage vs. Multi Stage Treatment, Filter Loadings, Rates of Flow and Results, Filter Depths, Recirculation, Sewage Pumps and Pump Control. Approximately 15 pages of blue prints are included in this instructive catalogue. Write Lakeside Engineering Co., 222 W. Adams St., Chicago 6, for a copy.

Air Release Valves

357. Automatic Air Release Valves for water, sewage and industrial uses are described and illustrated in new catalog issued by Simplex Valve & Meter Co., 6750 Upland St., Philadelphia 42, Pa.

358. Air Valves are the subject of Rensselaer Bulletin Q in which Air Release, as well as Air and Vacuum, types are described. Address: Rensselaer Valve Co., Troy, N. Y.

Analysis of Water

360. "Methods of Analyzing Water for Municipal and Industrial Use" is an excellent 94 page booklet with many useful tables and formulas. Sent on request by Solvay Sales Corp., 40 Rector St., New York 6, N. Y.

Activation and Aeration

367. A valuable booklet on porous diffuser plates and tubes for sewage treatment plants. Covers permeability, porosity, pore size and pressure loss data, with curves. Also information on installations, with sketches and pictures, specifications, methods of cleaning and studies in permeability. 20 pp. illustrated. Sent on request to Norton Company, Worcester 6, Mass.

Blowers

370. All interested in low cost air for sewage disposal will want a copy of this catalog describing operating principles and specifications of Roots-Connersville Aerating Blowers. Write to Roots-Connersville Blower Corp., 301 Valley Ave., Connersville, Ind.

Chlorinators, Portable

379. Complete data on new portable chlorinator designed to meet emergency calls quickly and efficiently. Write Wallace & Tiernan Co., Inc., Newark 1, N. J.

380. "Emergency Sterilization Equipment," a new bulletin describing the advantages of Dual Drive Chlor-O-Feeders which can serve as either a permanent chemical feeder or as a portable emergency chlorinator. Order from Proportioneers, Inc., 96 Codding St., Providence 1, R. I.

Cleaning Water Mains

383. Water main cleaning by the National Method is title of 4-page folder describing methods and results obtained, with full data. National Water Main Cleaning Co., 30 Church St., New York 7, N. Y.

Cleaning Sewers With Own Forces

385. A 20-page booklet describes and illustrates a full line of sewer cleaning equipment—Rods, Root Cutters, Buckets, Nozzles and Flushers. Write W. H. Stewart (Pioneer Mfr. since 1901), Jacksonville, Fla., or P. O. Box 767, Syracuse, N. Y.

386. 32-page illustrated booklet explains how a city can clean its sewers and culverts with its own forces using the up-to-date Flexible Sewer Rod equipment. Illustrates and describes all necessary equipment. Issued by Flexible Sewer Rod Equipment Co., 9059 Venice Boul., Los Angeles 34, Calif.

387. Literature illustrating how cities, towns and villages using OK Champion Sewer Cleaners are doing a complete sewer cleaning job from street level. Three sizes of machines available in addition to full line of sewer rods and accessories. Issued by Champion Corporation, 4752 Sheffield Avenue, Hammond, Indiana.

Consulting Engineers

389. "Who, What, Why" outlines briefly the functions of the consulting chemist and chemical engineer. Covers various methods of cooperation, on different types of problems, with industry, with attorneys and with individuals. Foster D. Snell, Inc., 305 Washington St., Brooklyn, N. Y., will send a copy on request.

Feeders, Chlorine, Amonia and Chemical

391. Feeders of all types including Hypochlorinators, Reagent Feeders, Dry Chemical Feeders, Chlorinators and Ammoniators are available in a wide range of capacities for feeding all of the usual chemicals used in sanitation practice—manufactured by Wallace & Tiernan Co., Newark 1, N. J.

392. For chlorinating water supplies, sewage plants, swimming pools and feeding practically any chemical used in sanitation treatment of water and sewage. Flow of water controls dosage of chemical; reagent feed is immediately adjustable. Starts and stops automatically. Literature from % Proportioneers, Inc. % 96 Codding St., Providence 1, R. I.

399. Pulsafeeders. A flow-proportional liquid chemical feeder, reciprocating type, fluid motor driven. Operating parts completely isolated from the chemical being fed. Micrometer adjustment. For feeding against high or low pressure. Wilson Chemical Feeders, Inc., 211 Clinton St., Buffalo 4, N. Y.

Filters

402. How to increase the capacity of filters through use of Anthrafilt and complete data on use of Anthrafilt for filters and sludge beds is contained in a revised pocket Manual issued by Anthracite Equipment Corp. For free copy write H. G. Turner, State College, Pa.

Filters, Vacuum

403. For bulletins on Vacuum Filters for dewatering primary, activated, digested or chemical sludge, write The Conkey Co., 420 Lexington Ave., New York 17, N. Y.

Fire Hydrants

406. See listing No. 438.

407. Fire hydrants which are flood-proof, easy to operate and service are described in Rensselaer Bulletin W., formerly known as "Coreys." Address: Rensselaer Valve Co., Troy, N. Y.

408. For a concise description and illustrations of the Improved MUELLER-COLUMBIAN Fire Hydrants, complete parts list and full directions for ordering—get the new folder just issued by Mueller Co., Chattanooga 1, Tenn.

Flow Meters

409. The primary devices for flow measurement—the orifice, the pilot tube, the venturi meter and others—and the application to them of the Simplex meter are described in a useful 24-page booklet (42A). Simplex Valve and Meter Co., 6750 Upland St., Philadelphia 42, Pa.

Gas Holders and Digesters

411. Digesters and Gas Holders for efficient collection and storage of sewage gas are described in an interesting illustrated booklet issued by Graver Tank & Mfg. Co., 332 South Michigan Ave., Chicago 4, Ill.

412. If your plans call for economical storage of digester gas, write for bulletin on Stacey Brothers All-Welded, High Pressure Spheres that combine safety with pleasing appearance. Stacey Brothers Gas Constr. Co., 5535 Vine St., Cincinnati 16, Ohio.

Gates, Valves, Hydrants

413. Gate, flap and check valves; floor stands and fittings. New catalog No. 34 gives detail information with dimensions for all types of new full line. M. & H. Valve & Fittings Co., Anniston, Ala.

415. See listing No. 438.

416. Check valves of the Clear-Way, Quiet-Closing type which eliminate "Slam" are described in Rensselaer Bulletin V. Made in expanding outlet type, as well as straight-thru type, for bolting direct to pump discharge. Address: Rensselaer Valve Co., Troy, N. Y.

417. Rensselaer Gate Valves of high tensile strength, corrosion resistant iron are described in Rensselaer Bulletin X. Address Rensselaer Valve Vo., Troy, N. Y.

418. A new four-page folder on MUELLER - COLUMBIAN Gate Valves gives construction details, shows various type of gear drive mechanism available, and has handy check list of dimensional data. Write Mueller Co., Chattanooga 1, Tenn.

419. Double-disc gate valves; hydraulically operated valves; air, check, flap and mud valves. Fire hydrants with sliding gate or balanced valve. A 32-page catalog. Ludlow Valve Mfg. Co., Inc., Troy, N. Y.

Gauges

421. The full line of Simplex gauges for filtration plants are illustrated and described in catalog issued by Simplex Valve and Meter Co., 6750 Upland St., Philadelphia 42, Pa.

Gunite

422. The advantages of Gunite for reservoir linings, steel encasement, sidewalls and roofs, waterproofing tanks, increasing strength of existing structures, lining sewers, etc., are illustrated in a 32 page catalog issued by National Gunite Corp., 420 Lexington Ave., New York 17, N. Y.

Laboratory Equipment

423. pH and Chlorine Control. A discussion of pH control and description of comparators, chlorimeters and similar devices. An 80-page booklet. W. A. Taylor & Co., 7301 York Road, Baltimore 4, Md.

Manhole Covers and Inlets

429. Street, sewer and water castings in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., Lafayette Boul. and Indiana Ave., South Bend 23, Ind.

Meters, Venturi

432. New bulletin illustrates Builders Air Relay system of transmission for the Venturi Meter which is particularly useful for liquids containing suspended solids like sewage. Eliminates corrosion, clogged pipes, etc. Write Builders-Providence, Inc., 9 Codding St., Providence 1, R. I.

433. "The Selection of Main Line Meters," a highly informative and useful presentation prepared by a competent engineer, J. C. Thoresen, describes forms of differential producers and quickly solves typical problems with the use of graphic charts. Write Builders-Providence, Inc., 9 Codding St., Providence 1, R. I.

Meters, Water

434. Six types of iron case cold water meters built for the duration, but to last for years are illustrated and described fully in folder issued by Pittsburgh Equitable Meter Co., 400 No. Lexington Ave., Pittsburgh 8, Pa.

435. "Watchdog" water meters, made in standard capacities from 20 GPM up; frost-proof or split case in household sizes. All parts interchangeable with present models of same manufacturer. For bulletins, write Worthington-Gamon Meter Co., 282-296 South St., Newark, N. J.

Pipe, Cast Iron

436. Handbook of Universal Cast Iron Pipe and Fittings, pocket size, 104 pages, illustrated, including 14 pages of useful reference tables and data. Sent by The Central Foundry Co., 386 Fourth Ave., New York 16, New York.

437. Cast iron pipe and fittings for water, gas, sewer and industrial service. Super-deLavaud centrifugally-cast and pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Burlington, N. J.

438. "Cast Iron Pipe and Fittings" is a well illustrated 44 page catalog giving full specifications for their complete line of Sand Spun Centrifugal Pipe, Fire Hydrants, Gate Valves, Special Castings, etc. Will be sent promptly by R. D. Wood Co., 400 Chestnut St., Philadelphia 5, Pa.

439. McWane Precaulked Joint Cast Iron Pipe, in all sizes from 1¼ through 12 inches for water and sewage, equipped with various type of factory-made joints, as well as B. & S. joints. Illustrated booklet issued by McWane Cast Iron Pipe Co., Birmingham, Ala.

Pipe, Transite

442. Two new illustrated booklets, "Transite Pressure Pipe" and "Transite Sewer Pipe" deal with methods of cutting costs of installation and maintenance of pipe lines and summarize advantages resulting from use of Transite pipes. Sent promptly by Johns-Manville Corp., 22 East 40th St., New York 16, N. Y.

Pipe Joints Sewer

444. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston, Adams, Mass.

Pipe Joint Compounds

446. The uses of Tegul-Mineralead for bell and spigot pipe and G-K Sewer joint compound are described in a 16-page illustrated booklet issued by Atlas Mineral Products Co., Mertztown, Pa. Includes useful tables for estimating quantities needed.

Pumps, Sludge

447. Carter Sludge Pumps are described in 8-page illustrated bulletin, including specifications and tables. Address: Ralph B. Carter Co., Hackensack, N. J.

448. Non-clogging, vertical or horizontal, dry pit or submerged; storm water and drainage pumps are described in several Bulletins; alo sump and bilge pumps. Dayton-Dowd Co., Quincy, Ill.

Pumps and Well Water Systems

449. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for descriptive booklets. Advertising Dept., Layne & Bowler, Inc., Box 186, Hollywood Station, Memphis 8, Tenn.

450. Peerless pumps in a variety of types, with oil or water lubrication and any power drive, to pump water from any depth are described and illustrated in new literature that clearly shows their construction and special features. Write Peerless Pump Div., Food Machinery Corp., 301 W. Ave. at 26th St., Los Angeles 31, Calif.

451. Oil lubricated turbine pumps with open impellers. Five types of heads available. Specifications and illustrations in new bulletin 6930M-2 issued by Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago 5, Ill.

452. Centrifugal Pumps of various designs—single-stage, double-suction, split casing; single-stage single-suction; two-stage opposed impeller; three-stage; high-pressure; fire pumps; close-coupled. A bulletin for each type. Dayton-Dowd Co., Quincy, Ill.

Meter Setting and Testing

454. The most complete catalog we have seen on setting and testing equipment for water meters—exquisitely printed and illustrated 48-page booklet you should have a copy of. Ask Ford Meter Box Co., Wabash, Ind.

Screens

456. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straightline Bar Screens" (Vertical and Inclined types). Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.

Sludge Drying and Incineration

458. "Disposal of Municipal Refuse." Complete specifications and description including suggested form of proposal; form of guarantees; statements and approval sheet for comparing bids with diagramatic outline of various plant designs. 48 pages. Address: Morse Boulger Destructor Co., 205-P East 42nd St., New York 17, N. Y.

459. Recuperator tubes made from Silicon Carbide and "Fireclay" Corebusters for maximum efficiency are described and illustrated in bulletin No. 11 issued by Fitch Recuperator Co., Plainfield National Bank Bldg., Plainfield, N. J.

Softening

462. This folder explains the process of Zeolite water softening and describes and illustrates the full line of equipment for that purpose made by the Graver Tank & Mfg. Co., 332 So. Michigan Ave., Chicago 4, Ill. Includes flow charts, tables and other valuable data. Write for a copy of this instructive folder.

463. Water Softening. The use of the Spaulding Precipitator to obtain maximum efficiency and economy in water softening is described in a technical booklet. Permutit Co., 330 W. 42nd St., New York 18, N. Y.

Sprinkling Filters

466. Design data on sprinkling filters of Separate Nozzle Field and Common Nozzle Field design as well as complete data on single and twin dosing tanks, and the various siphons used in them, for apportioning sewage to nozzles. Many time-saving charts and tables. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago 13, Ill.

Swimming Pools

468. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

Taste and Odor Control

470. "Taste and Odor Control in Water Purification" is an excellent 92-page, illustrated booklet covering sources of taste and odor pollution in water supplies and outlining the various methods of treatment now in use. Every water works department should have a copy. Write Industrial Chemical Sales Div., 230 Park Ave., New York 17, N. Y.

471. Technical pub. No. 207 issued by Wallace & Tiernan Co., Inc., Newark 1, N. J., describes in detail taste and odor control of water with BREAK-POINT Chlorination, a method of discovering the point at which many causes of taste may be removed by chlorination with little or no increase in residual chlorine. Sent free to any operator requesting it.

Treatment

475. Three types of clarifiers for sewage treatment are illustrated and described in a new bulletin issued by Graver Tank & Mfg. Co., 332 South Michigan Ave., Chicago 4, Ill.

476. "Safe Sanitation for a Nation," an interesting booklet containing thumbnail descriptions of the different pieces of P.F.T. equipment for sewage treatment. Includes photos of various installations and complete list of literature available from this company. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago 13, Ill.

477. All-steel Rotary Distributors, correctly designed for the small and medium sized sewage plants, are the subject of a new, well illustrated booklet issued by Graver Tank & Mfg. Co., 332 South Michigan Ave., Chicago 4, Ill. This booklet also covers distributors for various types of high-rate trickling filters.

478. New booklet (No. 1642 on Link-Belt Circuline Collectors for Settling Tanks contains excellent pictures; drawings of installations, sanitary engineering data and design details. Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.

480. New illustrated folder (1942) on Straightline apparatus for the removal and washing of grit and detritus from rectangular grit chambers. Address: Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.

481. "Sedimentation with Dorr Clarifiers" is a complete 36-page illustrated catalog with useful design data. Ask The Dorr Company, 570 Lexington Ave., New York 22, N. Y.

485. Dorrco Monorake for existing rectangular sedimentation tanks, open or closed, is described and illustrated in a new catalog sent on request. The Dorr Co., 570 Lexington Ave., New York 22, N. Y.

488. "Packaged" Sewage Treatment Plants, specifically developed for small communities—100 to 3,000 population. Write for full description and actual operating data for this type of plant. Chicago Pump Co., 2438 Wolfram St., Chicago 18, Ill.

489. "Carter Controlled Flocculation" is title of illustrated folder available on request from Ralph B. Carter Co., Hackensack, N. J.

490. Small type Conveyor Sludge Collector and Skimmer, Grit Collector, Aero-Filter and other equipment for small sewage treatment plants are described and illustrated in bulletins available from Chain-Belt Co., 1722 West Bruce St., Milwaukee 4, Wis.

Underdrains, Trickling Filter

492. Illustrated bulletin describes the Natco Unifilter block of glazed, hard burned clay for underdraining filter beds. Write National Fireproofing Corp., Pittsburgh 12, Pa., for free copy.

493. Full details about Armcre Filter Bottom Blocks for Trickling filter floors, includes drawings illustrating construction details. Complete bulletin available from The Bowerston Shale Co., Bowerston, Ohio.

Valves (See Gates, Air Release, etc.)

Water Treatment

495. If you have a water conditioning problem of any kind, write Graver Tank & Mfg. Co., 332 So. Michigan Ave., Chicago 4, Ill., who manufacture all types of conditioning equipment and will be pleased to make recommendations.

Water Service Devices

500. Data on anti-freeze outdoor drinking fountains, hydrants, street washers, etc., will be sent promptly on request to Murdock Mfg. & Supply Co., 426 Plum St., Cincinnati 2, Ohio.

Water Works Operating Practices

510. "Important Factors in Coagulation" is an excellent review with bibliography and outlines of latest work done in the field. Written by Burton W. Graham and sent free on request to Stuart-Brumley Corp., 516 No. Charles St., Baltimore, Md.

—"Soil Bearing Tests and Flexible Pavement Design," by Prevost Hubbard, Chemical Engineer.

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"Soil Bearing Tests and Flexible Pavement Design" is divided into a Review of Laboratory Tests and a statement of the broad objectives of the present cooperative Field Load-Bearing Tests being carried on cooperatively by the Highway Research Board of the National Research Council, the Public Roads Administration, and The Asphalt Institute. It contains twelve illustrative figures.

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